

## PATENT ABSTRACTS OF JAPAN

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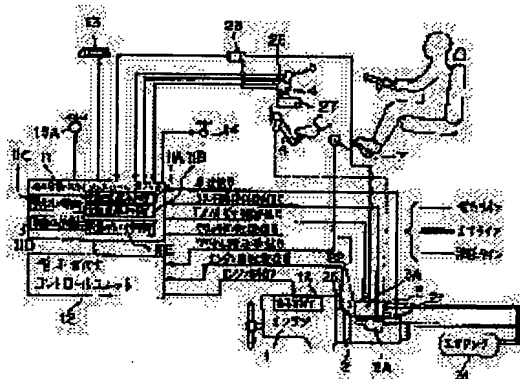
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## (54) SEMI-AUTOMATIC TRANSMISSION

## (57)Abstract:

**PURPOSE:** To surely avoid engine stop at the time of emergency by reducing the shift operating load of a driver largely without causing an increase in manufacturing cost and size.

**CONSTITUTION:** This semi-automatic transmission is provided with an actuator 2A for clutch, an actuator 3A for gear shifting of the transmission, a manual/automatic selective operation means 5 for switching between a manual shift mode for shifting the speeds of the transmission remotely by hand and an automatic shift mode for shifting the speeds automatically based on a speed selecting map, a shift operating means 4, and a control means 11 which electrically controls respective actuators according to these parameters of the means. An emergency brake control part 11E which controls so as to release a link with a clutch mechanism 2 automatically when an emergency brake is operated is also mounted.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] While carrying out the \*\*\*\* drive of this clutch mechanism according to the clutch mechanism which is characterized by providing the following and which was prepared in the output section of the engine for vehicles, and the operation of clutch pedal The actuator for clutches which operates according to an electrical signal and carries out the \*\*\*\* drive of this clutch mechanism, The change gear which offered the gear mechanism which can change gears the rotational speed by the driving torque inputted from this engine through this clutch mechanism for two or more gear ratios, The actuator for gearshifts which shifts this gear ratio to a necessary state while operating according to an electrical signal and changing the engagement state of the gear mechanism of this change gear, The hand control and the automatic selection operation means for changing alternatively the manual shift mode which shifts this gear ratio manually, and the auto-shift mode which shifts this gear ratio automatically, and an operation means to perform operation for carrying out the manual shift of this gear ratio A shift operation means to output the signal according to this operation An engine load detection means to detect the loaded condition of this engine A run state detection means to detect this rolling-stock-run state It is based on a signal from this hand control and automatic selection operation means, this shift operation means, and this run state detection means. If this manual shift mode is chosen for these control means by offering the control means which output a command signal to this actuator for clutches, and this actuator for gearshifts, and control the operation According to the signal from this accelerator instruction means and this shift operation means, a command signal is outputted to this actuator for gearshifts. The remote-operation control section for manual gear change which performs manual gear change control by remote operation, If this auto-shift mode is chosen, on condition that the gear ratio is set up in addition to the low-speed stage According to the detecting signal from this engine load detection means and this run state detection means, choose a gear ratio, referring to a gear ratio selection map, and the command signal which corresponds to this actuator for clutches and this actuator for gearshifts is outputted. An urgent brake judgment means to offer the remote-operation control section for automatic gear change which performs automatic gear change control, to consist of controlling clutch interception operation, gearshift operation, and clutch junction operation, and to judge the existence of urgent brakes operation, The urgent brake tense section which outputs a emergency control signal to this actuator for clutches so that junction of this clutch mechanism may be automatically canceled based on the information from this urgent brake judgment means at the time of urgent brakes operation

[Claim 2] Semi automatic formula change gear equipment according to claim 1 characterized by setting up this urgent brake judgment means so that it may judge that urgent brakes operation is performed as the deceleration of the vehicles at the time of brakes operation is more than default value.

[Claim 3] A wheel lock detection means to detect the lock state of the wheel of these vehicles, and a clutch \*\*\*\* detection means to detect interception operation of this clutch mechanism by this clutch pedal are offered. This urgent brake tense section during the control signal output of junction release of this clutch mechanism It is based on information from this wheel lock

detection means and this clutch \*\*\*\* detection means. On condition that interception operation of that this wheel is not in a lock state or this clutch mechanism is carried out Semi automatic formula change gear equipment according to claim 1 or 2 which suspends the output of this emergency control signal and is characterized by being set up so that it may be made to return to the manual clutch control according to operation of this clutch pedal.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Industrial Application]** The manual shift mode which this invention makes an electrical signal shift instructions of the gear ratio by manual operation, and carries out a gear change shift while transmitting to the actuator for gearshifts and operating this actuator for gearshifts by remote control, Offered the auto-shift mode in which the automatic gear change shift according to the rolling-stock-run state was performed. It is related with the semi automatic formula change gear equipment considered as an engine shutdown being avoidable at the time of the so-called urgent brakes operation which performs sudden braking operation, without performing isolation operation of a clutch mechanism especially about semi automatic formula change gear equipment.

**[0002]**

**[Description of the Prior Art]** In large-size cars, such as a bus and a truck, although a manual change gear is still in use, generally, it is mechanical, each of change levers (= shift operation means) of a drivers side and change gears attached to the output section of an engine is constituted from such a manual change gear, and it has structure which connected this change lever and change gear mechanically by link mechanisms, such as a control rod.

**[0003]** In such a mechanical change gear, it depends for the drive of the gear mechanism at the time of a shift on the shift operating physical force of a driver, and a necessary operating physical force is required of a driver. For this reason, when shift operation is especially required frequently like [ at the time of a city area run ], this shift operation serves as a big burden for a driver. Then, the actuator which performs the drive for the shift of the engagement state of the gear in a change gear was formed, and the change gear equipment of the remote-operation formula which operated this actuator by remote control through the electrical signal was developed.

**[0004]** It seems that namely, it shall be controlling an electromagnetic control valve as an actuator, for example by making pneumatic pressure, oil pressure, etc. into a driving source, and the engagement state of the gear in a change gear shall be shifted. If a change lever is operated, on the other hand, it constitutes so that a necessary electrical signal may be outputted according to this. And in response to the signal from a change lever, a necessary electrical signal is outputted to the control valve by the side of the actuator of a change gear, and it constitutes so that this control valve may be controlled.

**[0005]** By the small force of only operating a change lever, it can shift now and the burden of the driver about shift operation is mitigated by this.

**[0006]**

**[Problem(s) to be Solved by the Invention]** By the way, what is necessary is just to adopt an automatic transmission, in order to mitigate the burden of the driver about shift operation further. This automatic transmission enables it to perform a gear change shift in large-size cars, such as a bus and a truck, although what in the case of the small-size car replaced with the clutch and adopted the torque converter is in use, without forming the actuator which \*\*\*\* a clutch automatically like a manual change gear, and stepping on clutch pedal, since it becomes it

is large and excessive paying [ of a torque converter ] the amount of transfer of driving torque. [0007] However, at the time of \*\*\*\* of a clutch, since it is easy to cause the gear change shock and engine shutdown of vehicles, control of the rotational frequency of an engine etc. is simultaneously [ with performing \*\*\*\* operation of a clutch appropriately, and this ] needed so that such faults can be avoided. For example, it is necessary to perform a clutch meat gradually, and adjusting the rotation state of an engine, in case a clutch is hit accurately, it is necessary to control so that the rotation state of the input side of a clutch and an output side approaches gradually.

[0008] In order to fill such a demand, the steep increase in a manufacturing cost — the actuator itself which \*\*\*\* a clutch will become complicated, or control of this actuator will become complicated — and enlargement of equipment will be caused. By the way, when a gear ratio is a high-speed stage, it is also possible for delicate control not to be required of a clutch meat, for example, to perform \*\*\*\* of a clutch simply like on-off control.

[0009] Then, it is possible to constitute so that a gear ratio may change gears only by manual gear change rather than such a high-speed stage at the time of a low as automatic gear change can be performed as a means to solve an above-mentioned technical problem, only when a gear ratio is a high-speed stage. If it enables it to choose the favorite gear change mode of automatic gear change mode and the manual gear change modes especially when a gear ratio is a high-speed stage, it is convenient to a driver.

[0010] By the way, generally, by the vehicles which offered the manual change gear, if a brake is operated, the vehicle speed falls and a driver will not cut a clutch, an engine shutdown (engine failure) will be caused. On the other hand, in an automatic transmission, since the clutch operation of a driver is unnecessary, when a brake is operated and the vehicle speed falls, an engine failure can be avoided without the clutch operation of a driver.

[0011] By the vehicles which offered the manual change gear, it cannot but depend for evasion of the engine failure accompanying braking on operation of a driver. However, since a mental margin is lost to a driver at the time of an urgent brake (the thing of such an urgent brake is also called panic brake), he may forget this clutch OFF operation. When it enables it to choose automatic gear change mode and manual gear change mode as mentioned above especially, although the clutch OFF operation for the engine failure evasion accompanying braking is unnecessary at the time of automatic gear change mode, it is needed at the time of manual gear change mode. For this reason, a bird clapper is assumed that a driver tends to forget clutch OFF operation at the time of manual gear change, and a possibility of forgetting clutch OFF operation becomes still stronger at the time of an above-mentioned urgent brake.

[0012] It aims at offering the semi automatic formula change gear equipment which enabled it to also perform automatically engine failure evasion at the time of an urgent brake, enabling it to mitigate the various burdens of the driver about shift operation without causing the steep increase in a manufacturing cost, and enlargement of equipment, as it was originated in view of the above-mentioned technical problem and this invention can choose automatic gear change mode and manual gear change mode.

[0013]

[Means for Solving the Problem] For this reason, the semi automatic formula change gear equipment of this invention according to claim 1 While carrying out the \*\*\*\* drive of this clutch mechanism according to the clutch mechanism prepared in the output section of the engine for vehicles, and the operation of clutch pedal The actuator for clutches which operates according to an electrical signal and carries out the \*\*\*\* drive of this clutch mechanism, The change gear which offered the gear mechanism which can change gears the rotational speed by the driving torque inputted from this engine through this clutch mechanism for two or more gear ratios, The actuator for gearshifts which shifts this gear ratio to a necessary state while operating according to an electrical signal and changing the engagement state of the gear mechanism of this change gear, The hand control and the automatic selection operation means for changing alternatively the manual shift mode which shifts this gear ratio manually, and the auto-shift mode which shifts this gear ratio automatically, A shift operation means to be an operation means to perform operation for carrying out the manual shift of this gear ratio, and to output the signal according

to this operation, An engine load detection means to detect the loaded condition of this engine, and a run state detection means to detect this rolling-stock-run state, It is based on a signal from this hand control and automatic selection operation means, this shift operation means, and this run state detection means. If this manual shift mode is chosen for these control means by offering the control means which output a command signal to this actuator for clutches, and this actuator for gearshifts, and control the operation According to the signal from this accelerator instruction means and this shift operation means, a command signal is outputted to this actuator for gearshifts. The remote-operation control section for manual gear change which performs manual gear change control by remote operation, If this auto-shift mode is chosen, it will respond to a detecting signal from this engine load detection means and this run state detection means. Choose a gear ratio, referring to a gear ratio selection map, and the command signal which corresponds to this actuator for clutches and this actuator for gearshifts is outputted. An urgent brake judgment means to offer the remote-operation control section for automatic gear change which performs automatic gear change control, to consist of controlling clutch interception operation, gearshift operation, and clutch junction operation, and to judge the existence of urgent brakes operation, It is characterized by preparing the urgent brake tense section which outputs a emergency control signal to this actuator for clutches so that junction of this clutch mechanism may be automatically canceled based on the information from this urgent brake judgment means at the time of urgent brakes operation.

[0014] Moreover, in addition to composition according to claim 1, the semi automatic formula change gear equipment of this invention according to claim 2 is characterized by setting up this urgent brake judgment means so that it may judge that urgent brakes operation is performed as the deceleration of the vehicles at the time of brakes operation is more than default value. Moreover, the semi automatic formula change gear equipment of this invention according to claim 3 In composition according to claim 1 or 2, in addition, a wheel lock detection means to detect the lock state of the wheel of these vehicles, A clutch \*\*\*\* detection means to detect interception operation of this clutch mechanism by this clutch pedal is offered. This urgent brake tense section during the control signal output of junction release of this clutch mechanism It is based on information from this wheel lock detection means and this clutch \*\*\*\* detection means. It is characterized by being set up so that it may suspend the output of this emergency control signal and may return to the manual clutch control according to operation of this clutch pedal, on condition that interception operation of that this wheel is not in a lock state or this clutch mechanism is carried out.

[0015]

[Function] With the semi automatic formula change gear equipment of an above-mentioned this invention according to claim 1, either of the manual shift mode which shifts a gear ratio manually through hand control and an automatic selection operation means, and the auto-shift mode which shifts this gear ratio automatically is chosen first. And if manual shift mode is chosen and shift operation will be manually performed through a shift operation means, the command signal according to operation will be outputted from this shift operation means here. And in the actuator for gearshifts, the gear mechanism of a change gear is driven according to this command signal.

[0016] Moreover, at this time, the actuator for clutches carries out the \*\*\*\* drive of the clutch suitably according to the operation of clutch pedal. In control means, a command signal (electrical signal) is outputted to the actuator for gearshifts based on this signal. The actuator for gearshifts operates according to this command signal, and it shifts a gear ratio to a necessary state, changing the engagement state of the gear mechanism of a change gear.

[0017] On the other hand, if auto-shift mode is chosen, in control means, according to the detecting signal from this engine load detection means and this run state detection means, a gear ratio will be chosen referring to a gear ratio selection map, and a command signal will be outputted to the actuator for clutches, and the actuator for gearshifts. And if the so-called urgent brakes operation which performs sudden braking operation, without performing separation operation of a clutch mechanism is performed, an urgent brake judgment means will judge this. In the urgent brake tense section, a control signal is outputted to this actuator for clutches so that

junction of this clutch mechanism may be automatically canceled based on the information from this urgent brake judgment means at the time of urgent brakes operation. Thereby, at the time of sudden braking, separation of a clutch mechanism is performed automatically and a halt of the engine at the time of an urgent brake is avoided.

[0018] Moreover, with the semi automatic formula change gear equipment of this invention according to claim 2, since this urgent brake judgment means judged that urgent brakes operation was performed as the deceleration of the vehicles at the time of brakes operation is more than default value, after sudden braking is performed certainly, separation of a clutch mechanism is performed. Moreover, with the semi automatic formula change gear equipment of this invention according to claim 3, the lock state of the wheel of these vehicles is detected by the wheel lock detection means, and interception operation of this clutch mechanism by this clutch pedal is detected by the clutch \*\*\*\* detection means. And in this urgent brake tense section, when this wheel is not in a lock state, or when interception operation of this clutch mechanism is carried out during the control signal output of junction release of this clutch mechanism based on the information from this wheel lock detection means and this clutch \*\*\*\* detection means, the output of this emergency control signal is suspended. Thereby, this clutch mechanism returns to the manual clutch control according to operation of this clutch pedal.

[0019]

[Example] Hereafter, with a drawing, if the semi automatic formula change gear equipment as one example of this invention is explained The perspective diagram in which drawing 1 shows the typical block diagram, and drawing 2 shows the shift operation means (change lever), Drawing in which drawing 3 shows the shift pattern of the shift operation means (change lever), The typical block diagram in which drawing 4 shows the actuator for clutches, and the actuator for gearshifts, Drawing 5 , the flow chart with which 6 shows the flow (main routine) of the whole control, the flow chart with which drawing 7 shows the finger gear change control flow (finger gear change routine), and drawing 8 are flow charts which show the automatic gear change control flow (automatic gear change routine).

[0020] The diesel power plant 1 prepared in vehicles is equipped with the semi automatic formula change gear equipment of this example, and as shown in drawing 1 , the clutch mechanism 2 attached to the output section of an engine 1, the main part 3 of a change gear (main part of semi automatic transmission), the control means 11 for semi automatic transmission 3 (semi automatic T/M control unit), and the control means 12 for electronic centrifugal-spark-advancer 1A of an engine 1 (electronic centrifugal-spark-advancer control unit) are offered.

[0021] In addition, an engine 1 is a diesel power plant and has offered electronics control centrifugal-spark-advancer (electronic centrifugal spark advancer) 1A as mentioned above. The clutch mechanism 2 is attached in clutch booster 2A which functions as an actuator for clutches, and this clutch booster 2A carries out the \*\*\*\* drive of the clutch mechanism 2 according to the supply state of the air from an air tank 31.

[0022] The main part 3 of a change gear has the gear ratio of one step of seven steps of advance and go-astern, and gearshift unit (GSU) 3A as an actuator for gearshifts is attached. This gearshift unit 3A changes the shift drive of the gear ratio into a necessary state, changing the engagement state of the gear mechanism of the main part 3 of a change gear. And such electronic centrifugal-spark-advancer 1A, clutch booster 2A, and gearshift unit 3A are controlled by the semi automatic T/M control unit 11 and the electronic centrifugal-spark-advancer control unit 12 through an electrical signal.

[0023] In the semi automatic T/M control unit 11 The change lever unit 4 as a shift operation means, the hand control and the automatic circuit changing switch 5 as hand control and an automatic selection operation means (or automatic gear change selecting switch), the optimal shift switch 26 as an optimal shift mode setting means, the vehicle speed sensor 21, a clutch switch (illustration abbreviation), As a transmission gear sensor (illustration abbreviation) and the clutch rotational frequency sensor 22, the electronic centrifugal-spark-advancer control unit 12, the emergency switch 23, and a display means Change buzzer 13A and the alarm buzzer 14 which generate tone (PITSU sound) at the time of the \*\* display unit 13 and a mode change are connected, respectively.



[0024] In this semi automatic T/M control unit 11 At the time of manual shift mode, a command signal is outputted to gearshift unit 3A according to the signal from change lever 4A as clutch pedal 6 and a shift control lever. Remote-operation control-section 11A for manual gear change which performs manual gear change control by remote operation, At the time of auto-shift mode, a command signal is outputted to clutch booster 2A and gearshift unit 3A according to the detecting signal from amount sensor of treading in 7A of the accelerator pedal 7 as the vehicle speed sensor 21 and engine load sensor as a run state detection means. Remote-operation control-section 11B for automatic gear change which performs automatic gear change control by controlling clutch interception operation, gearshift operation, and clutch junction operation is offered.

[0025] Furthermore, urgent brake judgment means 11C, wheel lock detection means 11D, and urgent brake tense section 11E are offered on the semi automatic T/M control unit 11. Urgent brake judgment means 11C is set up in response to the signal concerning the deceleration (vehicle speed rate of change) of vehicles, such as a vehicle speed sensor or an order acceleration sensor, at the time of brakes operation so that it may judge that urgent brakes operation is performed as the deceleration of vehicles is more than default value (threshold) while it receives the signal which starts the existence of brakes operation with a brake switch (illustration abbreviation) etc. In addition, this threshold is a value big enough and brakes operation from which a wheel will be in the state near a lock or a lock is judged to be urgent brakes operation.

[0026] Although it detects the lock state of the wheel of vehicles, wheel lock detection means 11D is in a lock state, when the vehicle speed (wheel speed) becomes under default value, and if the vehicle speed (wheel speed) becomes more than default value, it will judge that it is not in a lock state here. Based on the information from urgent brake judgment means 11C, priority is given to urgent brake tense section 11E over other control at the time of urgent brakes operation, and it outputs a emergency control signal to gearshift unit (actuator for clutches) 3A so that junction of the clutch mechanism 2 may be canceled automatically. Thereby, even if a driver forgets to step on clutch pedal 6 at the time of an urgent brake, the clutch mechanism 2 has junction canceled automatically, and an engine shutdown is avoided.

[0027] In addition, if continuation of urgent clutch control becomes unnecessary as for urgent brake tense section 11E, it will finish this control and will return to the usual clutch control, i.e., \*\*\*\* control of the clutch mechanism corresponding to operation of clutch pedal 6. Here, it is set up when the wheel has returned to the state where it does not lock, from the lock state based on the information from a clutch switch (illustration abbreviation) that wheel lock detection means 11D and the operation state of clutch pedal are detected, or so that it may get into clutch pedal 6 and urgent clutch control may be canceled at the time of \*\*\*\*\*. Thereby, if it will be in the usual braking state, urgent clutch control will be canceled.

[0028] In addition, although the gear ratio made into the target at the time of automatic gear change control is set up on a map in the semi automatic T/M control unit 11 from the amount of accelerator pedal treading in as an engine load or throttle opening, and the vehicle speed Although the time of treading in to a brake pedal and the brake pedal have not broken in, when an exhaust brake is in an operating state, Without getting also into a brake pedal, the shift map (gear ratio selection map) according to each run state with the time (at the time [ Usually ] of a run) of there being also no exhaust brake in an operating state is prepared, and a gear change shift map is chosen according to each run state. Moreover, at the time of a run, three more sorts of gear change shift maps MAP are usually prepared.

[0029] That is, map map1N, map1P, and map1E are usually prepared as a shift map map1 at the time of gear change, and although map map1N is a standard shift map (normal shift map), it receives. Map map1P are the power shift map which enabled it to obtain a big engine output rather than this normal shift map map1N using the high rotation region of an engine. Map map1E is the economy shift map which enabled it to operate an engine economically rather than normal shift map map1N using the low rotation region of an engine.

[0030] Moreover, electronic centrifugal-spark-advancer 1A, the amount sensor 24 of accelerator treading in, the engine speed sensor 25, and the semi automatic T/M control unit 11 are

connected to the electronic centrifugal-spark-advancer control unit 12, respectively. In addition, the amount sensor 24 of accelerator treading in is attached to an accelerator pedal 7. And if manual shift mode is chosen through hand control and the automatic circuit changing switch 5, based on the instructions from the change lever unit 4, gearshift unit 3A will be operated by remote control through the semi automatic T/M control unit 11. In this case, although gear change shift control is carried out through the change lever unit 4 by operating the change lever unit 4 manually, since shift operation can be carried out by the very small operating physical force at the time of operation, this control is called finger touch control or finger control, and it replaces with manual shift mode and says also with finger touch shift mode.

[0031] Moreover, if auto-shift mode is chosen through hand control and the automatic circuit changing switch 5, under certain conditions, auto-shift mode is carried out, through the semi automatic T/M control unit 11, based on various kinds of information, gearshift unit 3A and clutch booster 2A will be operated by remote control, and electronic centrifugal-spark-advancer 1A will be operated by remote control through the electronic centrifugal-spark-advancer control unit 12 based on various kinds of information at the time of auto-shift mode. In addition, a gear ratio is the thing of the run state which can be set as the high-speed stage of the 4th \*\* - the 7th \*\*, and above-mentioned certain conditions depend on the following reasons [ carrying out auto-shift mode in this way, only when the high-speed stage can be chosen ].

[0032] That is, although it is easy to be generated while the clutch is having a low-speed stage, as for this, chosen, although it is easy to cause the gear change shock and engine shutdown of vehicles at the time of \*\*\*\* of a clutch, it is hard to be generated while the clutch is having a high-speed stage chosen. Therefore, when a clutch is a low-speed stage, it is necessary to adjust clutch \*\* very delicately that a gear change shock and an engine shutdown should be avoided, and clutch booster 2A will become complicated [ the control ] in a complicated thing inevitably. However, when a clutch is a high-speed stage, \*\*\*\* operation of a clutch can be performed only by simple on-off operation. then, the run state as which the high-speed stage can choose the operation conditions in auto-shift mode here so that complication of the structure of clutch booster 2A and complication of the control can be avoided — sometimes — being needed .

[0033] By the way, the change lever unit 4 has offered change lever 4A of a short stroke comparatively, as shown in drawing 2 , and hand control and the automatic circuit changing switch 5 are installed in the flank of this change lever 4A. The shift pattern of this change lever 4A It is shown in drawing 3 . N (neutral) and R (reverse), S (run) as a non-shift position, and UP as a shift up instruction position (shift up), Five positions with DOWN (down shift) as a down-shift instruction position are offered, and, as for the use shift pattern at the time of a run, S position, UP position, and the DOWN position have usually become a \*\*\*\*\* I type shift pattern in one train. Among these, by UP position and the DOWN position, although change lever 4A stops in this position even if it lifts a hand from change lever 4A after operation when it puts into each position of N position, R position, and S position, if its hold of change lever 4A is released, it will return to S position automatically.

[0034] Therefore, other than the time of shift operation, change lever 4A is in the position of N (neutral) or S (run), and cannot recognize the gear ratio chosen from the position of this change lever 4A. Then, with this equipment, the display unit 13 performs the display of the display of the present gear ratio, i.e., the 1st speed, the 2nd speed, the 3rd speed, the 4th speed, the 5th speed, 6 \*\*, 7 \*\*, and R (reverse) and N (neutral) in response to the signal from the semi automatic T/M control unit 11. Moreover, in the display unit 13, shift mode performs the display in auto-shift mode or manual shift mode by lighting or putting out lights of an automatic gear change indicator lamp.

[0035] And a command signal is outputted according to each position of N, S, UP, DOWN, and R. In addition, the transitional position between each position also outputs a command signal. That is, between S position and UP position, between S position and a DOWN position, the command signal according to S position is outputted, and the command signal according to N position is outputted between N position and S position between N position and R position. That is, only when change lever 4A goes into these positions, a command signal is carried out, and by the

transitional position, priority is given to N position signal over the 1st, and, as for the command signal of UP, DOWN, and R, is given to S position signal over the 2nd.

[0036] Moreover, the mechanism (reaction force grant mechanism) 27 which can give operation reaction force is formed in the change lever unit 4 at the time of operation of change lever 4A, and the state of extracting the state of giving reaction force, and reaction force, according to the command signal from the semi automatic T/M control unit 11 can be changed now by this reaction force grant mechanism. This reaction force grant mechanism 27 is a mechanism which gives the reaction force which goes to the position side of S or N near this UP, DOWN, and the R at the time of the operation to the shift position of UP, DOWN, and R. And near the position of N and S, it is controlled through the semi automatic T/M control unit 11 so that reaction force does not arise.

[0037] Moreover, although used for the usual gear change shift in manual gear change mode, change lever 4A can be used because of change operation of a shift map, when it switches to automatic gear change mode. That is, first, change lever 4A will be changed to the power shift map by the side of an economy rather than the present condition, if a shift up is operated, and when it switches to automatic gear change mode, although normal shift map map1N is usually used as the shift map shift map map1 at the time of gear change, if a down shift is operated, it will change to the power shift map by the side of power rather than the present condition after this.

[0038] That is, if the shift map map1 is normal shift map map1N at the time of the present usual gear change, it will change to economy shift map map1E by the side of an one-step economy rather than this by operation of a shift up, and will change to power shift map map1P by the side of one-step power rather than this by operation of a down shift. If the shift map map1 is economy shift map map1E at the time of the present usual gear change, it will change to normal shift map map1N by the side of one-step power rather than this by operation of a down shift, and if the shift map map1 is power shift map map1P at the time of the present usual gear change, it will change to normal shift map map1N by the side of an one-step economy rather than this by operation of a shift up.

[0039] Moreover, hand control and the automatic circuit changing switch 5 are mho mentor RISUITCHI, it is what (or it pushes) this switch 5 is contacted for, and shift mode is switched. That is, it changes to auto-shift mode by what (or it pushes) hand control and the automatic circuit changing switch 5 are contacted for at the time of manual shift mode, and changes to manual shift mode by what (or it pushes) hand control and the automatic circuit changing switch 5 are contacted for at the time of auto-shift mode.

[0040] Although it is satisfactory since there is no change in the state of hand control and the automatic circuit changing switch 5 itself also at the time of operation in the case of a contact switch, although this hand control and automatic circuit changing switch 5 can consider a contact switch, a press switch, etc., in adopting the switch which has a change of state at the time of operation of a press switch etc., it carries out an automatic-reset switch as shown in (A) of drawing 8 instead of on-off switch 5' as shown in (B) of drawing 8 as hand control and the automatic circuit changing switch That is, hand control and the automatic circuit changing switch 5 are considered as the return switch which returns to the state before operation automatically after operation.

[0041] In addition, in drawing 8, the press section (push button) of a switch, 5B and 5C, 5B', 5C', and 5D' of 5A and 5A' are contacts. By carrying out like this, hand control and the automatic circuit changing switch 5 are held at least at the state where it is always fixed in addition to the time of operation. And since, as for auto-shift mode or manual shift mode, shift mode is displayed on the display unit 13 by lighting or putting out lights of an automatic gear change indicator lamp as mentioned above, a driver can fully recognize a shift mode state also on stream.

[0042] The optimal shift switch 26 can be set as a direct shift up or the optimal shift mode which outputs a command signal so that a down shift may be carried out to the optimal gear ratio, flying an intermediate gear ratio, if change lever 4A goes into UP position or a DOWN position. That is, it will be in the state which put this optimal shift switch 26 into ON, if put into

change lever 4A by UP position, it will be the necessary area within an engine speed (in this example, they are 2300 or less rpm at 600 or more rpm), and will be the range of the 600 or more rpm of the best gear ratios SNmax, i.e., the minimum rotational frequency of the area within an engine speed, and it is the best gear ratio SNmax. It is set up as a target gear ratio SNC.

Moreover, it will be in the state which put this optimal shift switch 26 into ON, if put into change lever 4A by the DOWN position, it will be the necessary area within an engine speed (in this example, they are 2300 or less rpm at 600 or more rpm), and will be the range of the 2300 or less rpm of the lowest gear ratios SNmax, i.e., the upper limit rotational frequency of the area within an engine speed, and it is the lowest gear ratio SNmin. It is set up as a target gear ratio SNC.

[0043] In addition, a switch, the switch [ as ] which the state where it changed when turning on and off switched whenever it pushed by the hand, and the hand was lifted maintains can be considered so that it may return at OFF, if it is turned on only when it pushes by hand as an optimal shift switch 26, and a hand is lifted. It is constituted by the air-line system and oil pressure line system which drive gearshift unit 3A and clutch booster 2A as shown in drawing 4.

[0044] In drawing 4, 31 is a main air tank and emergency tank 31C is attached. 31A is a sub air tank and has offered the tank for brakes, and the wet tank. 31B is the sub air tank of the tank for brakes. Moreover, for 32, air piping (air hose) and 33 are [ a double check valve and 35A-35C of a check valve and 34 ] low air pressure switches.

[0045] 36A-36D are electromagnetic 3 way bulbs, and also call [ bulb 36A / MVH and bulb 36B ] MVR and bulb 36D MVW for MVP and bulb 36C here. 36E and 36F are electro-magnetic valves, bulb 36E performs air supply, MVX performs degassing and call and bulb 36E also calls it MVY here.

[0046] These electro-magnetic valves 36A, 36B, 36C, 36E, and 36F are changed by each according to the command signal from the semi automatic T/M control unit 11. It is for changing the reaction force state of change lever 4A, electromagnetic 3 way bulb 36A is made into the free passage state opened for traffic in an air hose 32 when giving reaction force to change lever 4A, and when extracting the reaction force of change lever 4A, it is made into a discharge state.

[0047] Electromagnetic 3 way bulb 36B is for changing the use state of the main tank 31 and emergency tank 31C, it is made into a discharge state so that air \*\* from the main tank 31 may usually sometimes be used, and it is made into a free passage state in emergency which the main tank 31 does not commit normally so that air \*\* from emergency tank 31C may be used.

[0048] Electromagnetic 3 way bulb 36C is for changing the shift force in gearshift unit 3A, and when it is made into a discharge state when making the shift force into a normal state (state which is not large), and enlarging the shift force, it is made into a free passage state. Moreover, if air \*\* is supplied to a clutch 2 by clutch booster 2A, it will be in an isolation state (OFF state), and if air \*\* of clutch booster 2A is extracted, it will be in a junction state (\*\*\*\*\*). And if electromagnetic bulb 36E operates, air \*\* is supplied to clutch booster 2A, and it will be in the isolation state of a clutch 2, and if electromagnetic bulb 36F operate, it is set up so that air \*\* of clutch booster 2A may be removed and it may be in the junction state of a clutch 2.

[0049] Electromagnetic 3 way bulb 36D in emergency when the drive system and control system of clutch booster 2A by the electromagnetic bulbs 36E and 36F which led failed such a semi automatic T/M control unit 11 in, and the clutch 2 changed into the isolation state It is for changing a clutch 2 to a junction state, and it considers as the free passage state usually opened for traffic in an air hose 32 sometimes, and considers as the discharge state of removing air \*\* of clutch booster 2A in emergency.

[0050] In this example, if hand control and the automatic circuit changing switch 5 are interlocked with, it turns on and off and a circuit changing switch 5 is set up automatically, electromagnetic 3 way bulb 36D is turned ON, will be in a free passage state, if a circuit changing switch 5 is set as manual shift mode, is turned OFF and will be in a discharge state. Therefore, if a circuit changing switch 5 is set as manual shift mode in emergency, air \*\* of clutch booster 2A is removed, and a clutch 2 will be in a junction state (\*\*\*\*\*).

[0051] In addition, clutch control by urgent brake tense section 11E is performed through bulb

36D (MVW) or control of bulb 36F (MVY). Moreover, as for 37A, kg [ of for example output air \*\* / 3.9 / / ] are [ cm ] the low voltage reducing valve of 2, and for example, output air \*\* of 37B is the high-pressure reducing valve of 7.5 kg/cm<sup>2</sup>.

[0052] 38 is a relay valve and this relay valve 38 is infixed in the air hose 32 which supplies air \*\* to clutch booster 2A from sub air-tank 31A. Moreover, this relay valve 38 is connected through master cylinder 6A and the oilway 41 which operate according to treading in to clutch pedal 6. When having not broken in clutch pedal 6 it will be in the discharge state which discharges air \*\* of clutch booster 2A, and a clutch 2 is made into a junction state, at the time of treading in to clutch pedal 6, it will be in the supply state which supplies air \*\* to clutch booster 2A, and a clutch 2 will be made into an isolation state.

[0053] Moreover, 39 is an air dryer. Furthermore, into gearshift unit 3A, although not illustrated, six electro-magnetic valves of MVA-MVF are prepared, and the engagement state of a gear mechanism is changed according to opening and closing of these bulbs. These electro-magnetic valve MVA-MVF is also changed according to the command signal from the semi automatic T/M control unit 11, respectively.

[0054] By the way, with this equipment, although manual shift mode and auto-shift mode were in the control mode of a change gear, when hand control and the automatic circuit changing switch 5 are set as manual shift mode, or when not filling the setups in auto-shift mode although the circuit changing switch 5 was set as auto-shift mode, it becomes manual shift mode. In this case, in the semi automatic T/M control unit 11, control of electro-magnetic valves 36A and 36C (getting it blocked MVH, MVR) and MVA-MVF is performed as the following.

[0055] if it does not get into clutch pedal 6 at the time of this manual shift mode, and a clutch switch is not turned on on namely,, it will change into the state (reaction force removal state) where reaction force is not applied to change lever 4A by making electromagnetic 3 way bulb 36A into a discharge state Moreover, even if this change lever 4A is operated with this, a change active signal is outputted to electro-magnetic valve MVA-MVF in gearshift unit 3A in any way.

[0056] On the other hand, if it gets into clutch pedal 6, in the semi automatic T/M control unit 11, it will consider as the state where reaction force can be given to change lever 4A by making electromagnetic 3 way bulb 36A into a free passage state, in response to the ON signal of a clutch switch. Moreover, according to operation of this change lever 4A, an active signal is outputted to electro-magnetic valve MVA-MVF in gearshift unit 3A with this. However, at this time, vehicles perform different control by the run state or the idle state.

[0057] In addition, the run state in this case is an advance run state, and it shall include in a idle state at the time of retreat, as compared with the threshold (\*\*\*\*\* vehicle speed value) to which vehicles were beforehand set in the vehicle speed detection value from the vehicle speed sensor 21, if judgment of a run state or a idle state has a vehicle speed detection value smaller than a threshold, it will judge it as a idle state, and if a vehicle speed detection value becomes more than a threshold, it can be judged to be a run state.

[0058] And if vehicles are idle states, if the shift instructions of the change lever 4A are carried out from N position to R position, an active signal will be outputted to the electro-magnetic valve to which it corresponds of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the engagement state of the gear mechanism of the main part 3 of a change gear will be changed from the semi automatic T/M control unit 11 to the treading-in state of clutch pedal 6 to R position.

[0059] In response to the gear ratio information actually chosen from the transmission gear sensor (illustration abbreviation), as compared with the instruction gear ratio (target gear ratio) outputted from the semi automatic T/M control unit 11, at this time, this will be judged that shift operation was completed by the semi automatic T/M control unit 11, if a selection gear ratio is in agreement with an instruction gear ratio. At the time of the shift of this change lever 4A, although electromagnetic 3 way bulb 36A is changed into a free passage state and it continues giving reaction force to change lever 4A like the above-mentioned until shift operation is completed, if shift operation is completed, electromagnetic 3 way bulb 36A will be changed into a discharge state, and the reaction force of change lever 4A will be removed.

[0060] If the shift instructions of the change lever 4A are carried out from N position during

treading in to clutch pedal 6 by the idle state of vehicles to S position, although the engagement state of the gear mechanism of the main part 3 of a change gear will be held only now at N state (neutral state) If it can come, and is alike, then shift instructions are carried out from S position to UP position An active signal is outputted to the electro-magnetic valve to which it corresponds of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the engagement state of the gear mechanism of the main part 3 of a change gear is changed from the semi automatic T/M control unit 11 to the 2nd \*\* position.

[0061] By the idle state of vehicles, during treading in to clutch pedal 6, if the shift instructions of the change lever 4A are carried out through S position to a DOWN position from N position, an active signal will be outputted to the electro-magnetic valve to which it corresponds of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the engagement state of the gear mechanism of the main part 3 of a change gear will be changed from the semi automatic T/M control unit 11 to the 1st \*\* position.

[0062] Also at the time of a shift into these 2nd \*\* positions and 1st \*\* positions, in the semi automatic T/M control unit 11 Until shift operation is completed in response to the gear ratio information actually chosen from the transmission gear sensor (illustration abbreviation) at the time of the shift of this change lever 4A If electromagnetic 3 way bulb 36A is changed into a free passage state, reaction force is given to change lever 4A and shift operation is completed like the above-mentioned, \*\* type 3 way bulb 36A will be changed into an eccrisis state, and the reaction force of change lever 4A will be removed.

[0063] In addition, if change lever 4A is returned to N position or S position before shift operation is completed at the time of each shift into above-mentioned R position and the above-mentioned 2nd \*\* position, or the 1st \*\* position, the engagement state of the gear mechanism of the main part 3 of a change gear will be returned to N state (neutral state). Moreover, if the shift instructions of the change lever 4A are carried out from S position or R position during treading in to clutch pedal 6 by the idle state of vehicles to N position, the engagement state of the gear mechanism of the main part 3 of a change gear will be changed to N state (neutral state).

[0064] On the other hand, the shift into R position of the main part 3 of a change gear is forbidden to the rolling-stock-run state (advance run state). That is, in the state of a rolling stock run, during treading in to clutch pedal 6, if the shift instructions of the change lever 4A are carried out from N position to R position, without outputting the shift signal according to these instructions, an active signal will be outputted to the warning buzzer 14, and warning will be emitted by the driver by beep sound from the semi automatic T/M control unit 11.

[0065] If the shift instructions of the change lever 4A are carried out from N position during treading in to clutch pedal 6 to S position, although the engagement state of the gear mechanism of the main part 3 of a change gear will be held only now in the state of a rolling stock run at N state (neutral state) If it can come, and is alike, then shift instructions are carried out from S position to UP position or a DOWN position, based on the detection information on the vehicle speed sensor 21, the optimal gear ratio will be set up by the semi automatic T/M control unit 11 according to the vehicle speed. And an active signal is outputted to the electro-magnetic valve corresponding to the gear ratio to which it was set of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the engagement state of the gear mechanism of the main part 3 of a change gear is changed from the semi automatic T/M control unit 11 to the optimal gear ratio position.

[0066] In the state of a rolling stock run, during treading in to clutch pedal 6, if the shift instructions of the change lever 4A are carried out from S position to UP position, unless the present gear ratio is already set as the highest speed gear (the 7th \*\*) by the semi automatic T/M control unit 11 except for the case where it is in a neutral state by S position, a gear ratio higher one step than the present gear ratio will be set up. And from this semi automatic T/M control unit 11, an active signal is outputted to the electro-magnetic valve corresponding to the gear ratio set up of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the shift up of the engagement state of the gear mechanism of the main part 3 of a change gear is carried out to the position of a gear ratio higher one step than the present gear ratio.

[0067] Unless overrun of an engine is caused for the gear ratio after a down shift, a gear ratio lower one step than the present gear ratio is set up, without having already set the present gear ratio as the minimum speed gear (the 1st \*\*) by the semi automatic T/M control unit 11 except for the case where it is in a neutral state, during treading in to clutch pedal 6 in the state of the rolling stock run by S position, if the shift instructions of the change lever 4A are carried out from S position to a DOWN position. And from this semi automatic T/M control unit 11, an active signal is outputted to the electro-magnetic valve corresponding to the gear ratio set up of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the down shift of the engagement state of the gear mechanism of the main part 3 of a change gear is carried out to the position of a gear ratio lower one step than the present gear ratio.

[0068] In addition, as mentioned above, the case where it is already set as the highest speed gear (the 7th \*\*) at the time of shift up instructions, when already being set as the minimum speed gear (the 1st \*\*) at the time of down-shift instructions, or when fear of overrun is after a down shift, an active signal is outputted to the alarm buzzer 14, and an alarm tone is emitted. Also at the time of a shift into these optimal gear ratio positions, a shift up, and a down shift, in the semi automatic T/M control unit 11 Until shift operation is completed in response to the gear ratio information actually chosen from the transmission gear sensor (illustration abbreviation) at the time of the shift of this change lever 4A If electromagnetic 3 way bulb 36A is changed into a free passage state, reaction force is given to change lever 4A and shift operation is completed like the above-mentioned, \*\* type 3 way bulb 36A will be changed into a discharge state, and the reaction force of change lever 4A will be removed.

[0069] Moreover, if change lever 4A is returned to N position or S position before shift operation is completed, the engagement state of the gear mechanism of the main part 3 of a change gear will be returned to N state (neutral state). If shift instructions are carried out from S position in this case to UP position or a DOWN position, according to the vehicle speed, it will be controlled by the optimal gear ratio as mentioned above.

[0070] furthermore, in the semi automatic T/M control unit 11 It is based on a vehicle speed signal, a clutch rotational frequency signal, and the gear ratio that is going to change gears from now on. It asks for the synchro load of a change gear. a synchro load at the time of the heavy load beyond a predetermined value (at the time [ For example, the ] of the change to 2 \*\*) Control electromagnetic 3 way bulb 36C in the free passage state, and a reducing valve is changed from low voltage reducing-valve 37A to high-pressure reducing-valve 37B. Air \*\* which is used by gearshift unit 3A for a shift and which can be set is enlarged, and the shift force is enlarged.

[0071] On the other hand, if hand control and the automatic circuit changing switch 5 are set as auto-shift mode and the setups in auto-shift mode are filled, it will become auto-shift mode. The operating state of an engine is controlled by controlling electronic centrifugal-spark-advancer 1A by the semi automatic T/M control unit 11 through the electronic centrifugal-spark-advancer control unit 12 in the case of this auto-shift mode, while performing control of electro-magnetic valves 36E and 36F (getting it blocked MVX, MVY) and MVA-MVF as the following as the following.

[0072] In addition, in this automatic mode, when the optimal gear ratio (let this be a target gear ratio) according to the amount of treading in of an accelerator pedal is set up and this target gear ratio differs from the actual gear ratio, unless overrun of an engine is caused for the gear ratio after the down shift in the case of a down shift, shift operation is performed as follows.

\*\* Perform accelerator return control first. That is, it controls to return an accelerator regardless of the operation state of an accelerator pedal. That is, usually, in response to the amount signal of treading in of an accelerator pedal, corresponding to this amount of treading in, electronic centrifugal-spark-advancer 1A is controlled by the electronic centrifugal-spark-advancer control unit 12, and the output state of an engine is adjusted by it. However, at the time of shift operation of this automatic mode, regardless of the amount signal of treading in, a control signal is outputted so that an accelerator may be returned, it replaces with the amount signal of treading in of an accelerator pedal, and electronic centrifugal-spark-advancer 1A is controlled by the electronic centrifugal-spark-advancer control unit 12 with this accelerator



return signal from the semi automatic T/M control unit 11.

[0073] \*\* A clutch will be cut if an accelerator returns. that is, if an accelerator returns, and electronic centrifugal-spark-advancer 1A will be in the state of corresponding when an accelerator returns namely, — The signal according to this is outputted from the electronic centrifugal-spark-advancer control unit 12. in the semi automatic T/M control unit 11 In response to this signal, an operation command signal is outputted to electromagnetic bulb 36E, electromagnetic bulb 36E is operated, air \*\* is supplied to clutch booster 2A, and a clutch 2 is changed into an isolation state (OFF).

[0074] \*\* If a clutch goes out, a gear will be returned to a neutral. That is, if the signal corresponding to the clutch having gone out is outputted from a clutch switch, in the semi automatic T/M control unit 11, in response to this signal, an active signal will be outputted to the necessary electro-magnetic valve of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the engagement state of the gear mechanism of the main part 3 of a change gear will be returned to a neutral position.

[0075] \*\* If a gear returns to a neutral, the rotational frequency of an engine will be controlled so that the rotational-speed difference between the I/O shafts of a clutch becomes from a target gear ratio and the vehicle speed within predetermined. That is, if the signal corresponding to the gear having returned to the neutral is outputted from a transmission gear sensor, in response to this signal, the target rotational frequency of an engine will be set up from a target gear ratio and the real vehicle speed, and electronic centrifugal-spark-advancer 1A will be controlled by the electronic centrifugal-spark-advancer control unit 12 so that the rotational frequency of the actual engine obtained from an engine speed sensor 22 approaches a target rotational frequency.

[0076] \*\* On the other hand, shift a gear to a target gear ratio. That is, an active signal is outputted to the necessary electro-magnetic valve of electro-magnetic valve MVA-MVF of gearshift unit 3A, and the engagement state of the gear mechanism of the main part 3 of a change gear is shifted from the semi automatic T/M control unit 11 to a target gear ratio. \*\* A clutch will be joined, if a shift for the target gear ratio of a gear is completed and the rotational frequency of an engine is further controlled by the necessary state. That is, in the semi automatic T/M control unit 11, it judges whether the gear was shifted from this signal and command signal to the target gear ratio in response to the signal which shows the present gear ratio from a transmission gear sensor. Moreover, in the electronic centrifugal-spark-advancer control unit 12, it judges whether the rotational frequency of a real engine approached within fixed to the target rotational frequency from this signal and target engine speed in response to the signal which shows the present engine speed from an engine speed sensor 25. And if the rotational frequency of a real engine approaches from the electronic centrifugal-spark-advancer control unit 12 within fixed to a target rotational frequency, the signal of the purport which completed engine-speed control will be outputted. In the semi automatic T/M control unit 11, in response to this signal, an operation command signal is outputted to electromagnetic bulb 36F, electromagnetic bulb 36F are operated, air \*\* of clutch booster 2A is removed, and a clutch 2 is changed into a junction state.

[0077] \*\* If junction of a clutch is completed, shift operation will be finished and accelerator adjustment will return to the usual state corresponding to the operation state of an accelerator pedal. That is, if the signal corresponding to the clutch having joined is outputted from a clutch switch, while the output of the imagination amount signal of treading in from the semi automatic T/M control unit 11 will be finished, in the electronic centrifugal-spark-advancer control unit 12, it returns to the usual control state which controls electronic centrifugal-spark-advancer 1A corresponding to the amount signal of treading in of an accelerator pedal, and adjusts the output state of an engine.

[0078] Moreover, the emergency switch 23 is a switch for having been offered and prepared at the time of the emergency fail of the semi automatic T/M control unit 11, and changing the command signal from change lever 4A to the direct-control mode sent to direct gearshift unit 3A, without making the semi automatic T/M control unit 11 intervene.

[0079] Since the semi automatic formula change gear equipment as one example of this



invention is constituted as mentioned above, as it is usually sometimes shown except for (jamming and emergency at), drawing 5 -7 [ for example, ], shift operation of a change gear 3 is performed. That is, in response to the information from an ignition key switch, as shown in drawing 5 and 6 with starting of an engine, this shift operation is started. In addition, at the time of a shift control start, the control flag FINFLG is set as 1 and the control flag FLGEMG is set as 0. Moreover, the control flag FH is set as 1 and each of control flags FS, FU, FD, FB, FN, FAC1, FCR1, and FGN, FSNC(s), and FCR2 is set as 0. In addition, these flags are explained later.

[0080] First, although control of the step of Steps M20-M31 shown in drawing 6 is performed, it progresses to Step 1 which usually shows these steps to drawing 5 from the necessary step in these steps M20-M31, concerning control the time of the urgent brake of a clutch, and control is substantially started from this step 1. That is, if it is judged whether it gets into the brake pedal at Step M20 and it does not get into the brake pedal, it progresses to Step M27 and it is judged whether the control flag FLGEMG is 1. This control flag FLGEMG is set to 1 at the time of control at the time of the urgent brake of a clutch, and usually, since it is sometimes 0, it progresses to Step 1 shown from Step M27 at drawing 5.

[0081] However, if it is judged that it gets into the brake pedal at Step M20, it will progress to Step M21 and it will be judged whether the control flag FLGEMG is 1. Still, if control is not started at the time of the urgent brake of a clutch, the control flag FLGEMG is 0 and progresses to Step M23. Although it is judged at this step M23 whether the deceleration (vehicle speed rate of change) of vehicles is more than default value (threshold), this judgment is performed in urgent brake judgment means 11C. If the deceleration (vehicle speed rate of change) of vehicles becomes more than default value (threshold), urgent brakes operation will be required and will progress to Step M24. Moreover, if the deceleration (vehicle speed rate of change) of vehicles is not more than default value (threshold), it will judge that urgent brakes operation is not performed and will progress to Step M1 shown in drawing 5.

[0082] At Step M24, if it is judged whether clutch pedal 6 is operated and clutch pedal 6 is not operated, urgent brakes operation is required, it progresses to Step M25 and a clutch OFF signal (command signal of which combination of the clutch mechanism 2 is canceled) is outputted from urgent brake tense section 11E irrespective of control 6, i.e., clutch pedal, at the time of the urgent brake of a clutch. And the return of the control flag FLGEMG is set and carried out to 1 at Step M26.

[0083] Moreover, if clutch pedal 6 is operated, since control is unnecessary at the time of the urgent brake of a clutch, it progresses to Step M30, and clutch \*\*\*\*\* (this is not the signal that combines the clutch mechanism 2 but a signal changed into a combinable state according to clutch pedal 6) is outputted from urgent brake tense section 11E so that a clutch may be \*\*\*\*\*(ed) corresponding to operation of clutch pedal 6.

[0084] And at Step M31, the control flag FLGEMG is set to 0 and it progresses to Step M1 shown in drawing 5. If treading-in operation of such a brake pedal is continued, in the following control cycle, it will progress to Step M22 through Step M21 from Step M20, and the vehicle speed (wheel speed) will judge whether it is more than default value. This judgment is performed in wheel lock detection means 11D.

[0085] If the vehicle speed (wheel speed) becomes more than default value, it can judge that a wheel is not in a lock state, and it will progress to Step M30, and since control is unnecessary at the time of the urgent brake of a clutch, clutch \*\*\*\*\* (it is the signal changed into a combinable state according to clutch pedal 6) will be outputted from urgent brake tense section 11E like \*\*\*\*\* so that a clutch may be \*\*\*\*\*(ed) corresponding to operation of clutch pedal 6. And at Step M31, the control flag FLGEMG is set to 0 and it progresses to Step M1 shown in drawing 5.

[0086] If the vehicle speed (wheel speed) is not more than default value, since a wheel is in a lock state and it is necessary to make control continue at the time of the urgent brake of a clutch Unless it is probably judged at Step M24 like \*\*\*\*\* that clutch pedal 6 is operated It progresses to Step M25 and a clutch OFF signal (command signal of which combination of the clutch mechanism 2 is canceled) is outputted from urgent brake tense section 11E irrespective

of control 6, i.e., clutch pedal, at the time of the urgent brake of a clutch. And the return of the control flag FLGEMG is set and carried out to 1 at Step M26. Of course, if it is judged at Step M24 that clutch pedal 6 is operated, control will be canceled like \*\*\*\* at the time of an urgent brake.

[0087] On the other hand, if treading in to a brake pedal is canceled while controlling at the time of an urgent brake, it will progress to Step M28 through Step M27 from Step M20, and the vehicle speed (wheel speed) will judge whether it is more than default value. If the vehicle speed (wheel speed) becomes more than default value, it can judge that a wheel is not in a lock state, and it will progress to Step M30, and since control is unnecessary at the time of the urgent brake of a clutch, clutch \*\*\*\*\* (it is the signal changed into a combinable state according to clutch pedal 6) will be outputted from urgent brake tense section 11E like \*\*\*\* so that a clutch may be \*\*\*\*(ed) corresponding to operation of clutch pedal 6. And at Step M31, the control flag FLGEMG is set to 0 and it progresses to Step M1 shown in drawing 5.

[0088] A wheel is in a lock state, and if the vehicle speed (wheel speed) is not more than default value, since it is necessary to make control continue at the time of the urgent brake of a clutch, it will progress to Step M29 from Step M28. At Step M29, it is judged like Step M24 whether clutch pedal 6 is operated. Unless treading-in operation of the clutch pedal 6 is carried out, control is required at the time of an urgent brake, it progresses to Step M25 and a clutch OFF signal (command signal of which combination of the clutch mechanism 2 is canceled) is outputted from urgent brake tense section 11E irrespective of control 6, i.e., clutch pedal, at the time of the urgent brake of a clutch. And the return of the control flag FLGEMG is set and carried out to 1 at Step M26. Of course, if it is judged at Step M24 that clutch pedal 6 is operated, control will be canceled like \*\*\*\* at the time of an urgent brake.

[0089] Hereafter, it returns to drawing 5 and Step M1 or subsequent ones is explained. or [ first, / that hand control and the automatic circuit changing switch (automatic gear change selecting switch) 5 were operated at Step M1 ] (if touched) — it is judged how it is If hand control and the automatic circuit changing switch 5 are not operated, it progresses to Step M13 and the control flag FINFLG judges whether it is 1. Since the control flag FINFLG is set as 1 at the time of the start of operation, it progresses to Step M14 from Step M13.

[0090] Although a command signal is outputted to change buzzer 13A and a buzzer (PITSU sound) can be sounded with Step M14 only when the control flag FINFLG is 0, since the control flag FINFLG is 1, it progresses to Step M15 here, without sounding a buzzer. The automatic gear change indicator lamp of the display unit 13 is made to switch off at Step M15. At continuing Step M16, finger gear change control is performed, performing a finger gear change routine, and in Step M17, the control flag FINFLG is set to 1 and it returns to an initial step.

[0091] And if hand control and the automatic circuit changing switch 5 are operated from this state, by judgment of Step M1, it will progress to Step M2 and the control flag FINFLG will judge whether it is 1. Since the control flag FINFLG is 1 at this time, it progresses to Step M3. At Step M3, it is judged whether there is any vehicle speed beyond a predetermined value (here 30 km/h).

[0092] If there is beyond no predetermined value [ vehicle speed ], it is still finger gear change control, and it will progress to Step M14 and finger gear change control and operation about this will be continued by each step of Steps M15, M16, and M17. If there is the vehicle speed beyond a predetermined value, it will progress to Step M4 and will judge whether the present gear ratio which is the setups in auto-shift mode is more than the 4th speed (4th) based on the signal of a transmission gear sensor (that is, is the gear ratio set as either of the 4 - 7 \*\* or not?).

[0093] If the present gear ratio is not more than the 4th speed, it will progress to Step M15, without progressing to Step M14, and sounding buzzer 13A, since the control flag FINFLG is 1. And like \*\*\*\*, at Step M15, the automatic gear change indicator lamp of the display unit 13 is made to switch off, and finger gear change control is performed, performing a finger gear change routine at Step M16, and the control flag FINFLG is set to 1 and it returns to an initial step by Step M17.

[0094] If the present gear ratio becomes above the 4th speed, it will progress to Step M5 and will be judged about whether it gets into the clutch pedal (C/L) which is the condition resolute

in auto-shift mode. If it gets into clutch pedal (C/L), it progresses to Step M14, and like \*\*\*\*, Step M15 – Step M17 will be performed, and it will return to an initial step.

[0095] If it does not get into clutch pedal (C/L), it progresses to Step M6 and it is judged whether the change lever position which is the setups in auto-shift mode has become S, U (UP), or D (DOWN). If the change lever position has not become S, U (UP), or D (DOWN), it progresses to Step M14, and like \*\*\*\*, Steps M15, M16, and M17 are performed, and it returns to an initial step.

[0096] If the change lever position has become S, U (UP), or D (DOWN), it will progress to Step M7 and it will be judged for an engine speed whether it is below a predetermined value (600rpm). If an engine speed becomes below a predetermined value, it will warn of it progressing to Step M8, a command signal being outputted to change buzzer 13A, a buzzer (PITSU sound) being sounded, and there being fear of an engine failure. Such a warning will not be performed if an engine speed is not below a predetermined value.

[0097] And a driver is told about having switched to auto-shift mode by a command signal being outputted to change buzzer 13A, and a buzzer (PITSU sound) being sounded with Step M10 which progress to Step M9 in any case, it makes the automatic gear change indicator lamp of the display unit 13 turn on, and follows, when the control flag FINFLG is 1.

[0098] And it progresses to Step M11, automatic gear change control is performed, performing an automatic gear change routine, and at Step M12, the control flag FINFLG is set to 0 and it returns to an initial step. Then, if hand control and the automatic circuit changing switch 5 are not operated, since the control flag FINFLG is 0, it progresses to Step M19 through Step M13 from Step M1. At Step M19, it is judged whether there is any vehicle speed beyond a predetermined value (here 30 km/h). If there is beyond no predetermined value [ vehicle speed ], it will progress to Step M18, a command signal will be outputted to change buzzer 3A, and it will sound and warn to change to finger gear change of a buzzer (PITSU sound). Such a warning will not be performed if there is the vehicle speed beyond a predetermined value. Then, progress to Step M4 and it goes via Steps M5, M6, and M7 (M8) further. [ whether operation which starts auto-shift mode at Steps M9, M10, M11, and M12 is performed, and ] Or from one step of Steps M4, M5, and M6, it progresses to Step M14 and operation which starts finger gear change in manual shift mode at Steps M14, M15, M16, and M17 is performed. At this time, since the control flag FINFLG is 0, a driver is told about having switched to manual shift mode by a command signal being outputted to change buzzer 13A, and a buzzer (PITSU sound) being sounded with Step M14.

[0099] And if hand control and the automatic circuit changing switch 5 are operated at the time of auto-shift mode, i.e., when the control flag FINFLG is 0, it progresses to Step M2 from Step M1, and it will pass along No root by Step M2, will progress to Step M14, and operation which starts finger gear change in manual shift mode at Steps M14, M15, M16, and M17 will be performed. A driver is told about having switched to manual shift mode by a command signal being outputted to change buzzer 13A, and a buzzer (PITSU sound) being sounded with Step M14 also at this time, since the control flag FINFLG is 0.

[0100] Thus, although main routine control is performed, an example of control in manual shift mode, i.e., finger gear change control, is concretely explained with reference to the flow chart of drawing 7 here. As shown in drawing 7, the signal from each sensor or switches is first inputted into the semi automatic T/M control unit 11 at Step F1.

[0101] And it judges whether treading in to clutch pedal was at Step F2. If there is no treading in to clutch pedal, it will progress to Step F60 from Step F2, and Flag FH will be set as 1. This flag FH is set to 1 when reaction force may be given to change lever 4A, and at the time of a control start, this flag FH is set as 1.

[0102] And if treading in to clutch pedal is, it will progress to Step F3 from Step F2, and it will be judged whether Flag FH is 1. Since Flag FH is 1, it progresses to Step F4 and changes into the state where reaction force can be given to change lever 4A in the first stage which broke in clutch pedal. Namely, if change lever 4A is shifted to a position (UP, DOWN, near [ each ] the position of R), a control signal is outputted from the semi automatic T/M control unit 11, and it will be in the state of changing electromagnetic 3 way bulb 36A into a free passage state,

operating the reaction force grant mechanism 27, and giving reaction force to change lever 4A. For this reason, if change lever 4A is operated into each position of UP, DOWN, and R, a driver can acquire the feel which is carrying out shift operation in response to suitable operation reaction force here.

[0103] Subsequently, a run state or a idle state is judged for vehicles at Step F5. In addition, the run state in this case is an advance run state, and it includes in a idle state at the time of retreat. At the time of starting of vehicles, since vehicles have naturally stopped, it progresses to Step F61, and it is a step after this and shift operation is performed according to the position of change lever 4A.

[0104] If change lever 4A is changed from N position to S position at the time of starting of vehicles, from Step F61, it will progress to Step F74 and it will be judged whether Flag FS is 1. This flag FS is set to 0 after [ when carrying out shift operation to UP position or the DOWN position, before it is referred to as 1 (namely, under shift control) and change lever 4A is in shift operation ] completion of shift operation.

[0105] In addition, the shift instructions to which this flag FS was set between 1 are continued. At the time of starting, since Flag FS is 0, after Step F74, a return is carried out to a main routine without performing shift control. Henceforth, the return to a main routine is only called return. And if it changes from this S position to UP position at the time of a halt, from Step F61, it will progress to Step F71 through Steps F62 and F70, the 2nd speed (2nd) will be set up as a target gear ratio SNC, it will progress to Step F64, and the command signal corresponding to either of electro-magnetic valve MVA-MVF will be outputted. At the time of these 2nd speed instructions, a command signal which will be in a free passage state is outputted to electromagnetic 3 way bulb 36C so that the shift force may become large.

[0106] Subsequently, it progresses to Step F65, Flag FS is set as 1, it is judged at Step F66 based on an actual gear ratio detecting signal whether the real gear ratio SNR is equal to the target gear ratio SNC, and a return is carried out if the real gear ratio SNR is not equal to the target gear ratio SNC. In addition, the real gear ratio SNR is equal to the target gear ratio SNC, and a bird clapper is equivalent to the shift having been completed.

[0107] And if UP position is held, the step of Steps F1, F2, F3, F4, F5, F61, F62, F70, F64, F65, and F66 will be repeated, and shift instructions will be continued. In this way, if the shift to the 2nd speed is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F67 and the reaction force of change lever 4A will be removed from Step F66. That is, output a control signal from the semi automatic T/M control unit 11, change electromagnetic 3 way bulb 36A into an eccrisis state, the reaction force grant mechanism 27 is made to cancel, and the reaction force of change lever 4A is extracted.

[0108] Furthermore, Flag FH is set to 0 at Step F68, and the return of the flag FS is carried out and carried out to 0 at Step F69. Moreover, if it changes from S position to a DOWN position at the time of a halt, from Step F61, it will progress to Step F73 through Steps F62, F70, and F72, the 1st speed (1st) will be set up as a target gear ratio SNC, it will progress to Step F64, and the command signal corresponding to either of electro-magnetic valve MVA-MVF will be outputted.

[0109] Subsequently, it progresses to Step F65, Flag FS is set as 1, it is judged at Step F66 based on an actual gear ratio detecting signal whether the real gear ratio SNR is equal to the target gear ratio SNC, and a return is carried out if the real gear ratio SNR is not equal to the target gear ratio SNC. And if a DOWN position is held, the step of Steps F1, F2, F3, F4, F5, F61, F62, F70, F72, F73, F64, F65, and F66 will be repeated, and shift instructions will be continued. If the shift to the 1st speed is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F67 and the reaction force of change lever 4A will be removed from Step F66 like \*\*\*\*. And Flag FH is set to 0 at Step F68, and the return of the flag FS is carried out and carried out to 0 at Step F69.

[0110] However, although change lever 4A was changed to UP position or the DOWN position When change lever 4A has been returned to S position before completion of shift operation Since Flag FS is 1, it progresses to Step F74 through Steps F1, F2, F3, F4, F5, and F61. It progresses to Step F75 from this step F74, and the signal which sets up the neutral value N as a target gear ratio SNC, and corresponds is outputted to either of electro-magnetic valve MVA-

MVF.

[0111] Furthermore, it progresses to Step F76 and it is judged whether the real gear ratio SNR is equal to the target gear ratio SNC (here the neutral value N), and a return is carried out if the real gear ratio SNR is not equal to the target gear ratio SNC. And if the step of Steps F1, F2, F3, F4, F5, F61, F74, F75, and F76 is repeated, a shift in a neutral is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, from Step F76, it will progress to Step F77, and the return of the flag FS will be carried out and carried out to 0.

[0112] Moreover, if it changes from N position to R position at the time of a halt, the signal which progresses to Step F63 through Step F62, sets up Reverse R as a target gear ratio SNC, and progresses and corresponds to Step F64 from Step F61 will be outputted to either of electro-magnetic valve MVA-MVF. Subsequently, it progresses to Step F65, Flag FS is set as 1, it is judged at Step F66 based on an actual gear ratio detecting signal whether the real gear ratio SNR is equal to the target gear ratio SNC, and a return is carried out if the real gear ratio SNR is not equal to the target gear ratio SNC.

[0113] And if R position is held, the step of Steps F1, F2, F3, F4, F5, F61, F62, F63, F64, F65, and F66 will be repeated, and the shift to reverse will be completed. If the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F67 and the reaction force of change lever 4A will be removed from Step F66 like \*\*\*\*. And at Step F68, Flag FH is set to 0, Flag FS is set to 0 at Step F69, and a return is carried out.

[0114] Of course, if change lever 4A is returned to this middle to N position, through Steps F1, F2, F3, F4, F5, F61, F62, F70, F72, and F74, it will progress to Step F75 and the signal which sets up neutral N as a target gear ratio SNC, and corresponds will be outputted to either of electro-magnetic valve MVA-MVF. And like the above-mentioned, if the real gear ratio SNR becomes equal to the target gear ratio SNC (here the neutral value N), from Step F76, it will progress to Step F77, and the return of the flag FS will be carried out and carried out to 0.

[0115] Although change lever 4A was changed to R position, it operates, as well as \*\*\*\* when change lever 4A has been returned to N position before completion of shift operation. After shifting to the neutral of this step F75 Since neither the step which removes reaction force, nor the step which sets Flag FH to 0 is prepared Unless a shift into each position of UP, DOWN, and R is completed, while continuing stepping on a clutch, it is the following control cycle, and it is judged as "Yes" at Step F3, progresses to Step F4, and the signal which can give reaction force at this step F4 is outputted. Therefore, continuing stepping on a clutch, again, when it is going to shift to each position of UP, DOWN, and R, reaction force is given like \*\*\*\*. Of course, as mentioned above, if a shift into each position of UP, DOWN, and R is completed, since Flag FH is set to 0, it will not progress to Step F4 and the signal which can give reaction force will not be outputted at Step F67. Therefore, at this time, continuing stepping on a clutch, again, even if it is going to shift to each position of UP, DOWN, and R, reaction force is not given.

[0116] Thus, if a rolling stock run is started while a gear ratio is shifted to the advance position of the 2nd speed or the 1st speed, or reverse (retreat position), stops treading in to clutch pedal and changes a clutch 2 into a connection state, vehicles will run with this set-up gear ratio. Moreover, by having stopped treading in to clutch pedal, if it progresses to Step F60 from Step F2, Flag FH will be changed to 1 and it will change into the state where reaction force can be given to change lever 4A.

[0117] And by the run state beyond a predetermined value, if a driver breaks in clutch pedal, like the above-mentioned, through Step F3, the vehicle speed will progress to Step F4, and will give reaction force to change lever 4A from Steps F1 and F2. Thereby, like the above-mentioned, if change lever 4A is operated, a driver can acquire the feel which is carrying out shift operation in response to suitable operation reaction force.

[0118] And shift operation is performed according to the position of change lever 4A. That is, first, at Step F5, vehicles are judged to be a run state and progress to Step F6. At the time of a run, since change lever 4A is usually S position, it progresses to Step F50 from Step F6 with this S position.

[0119] At this step F50, Flag FU judges in 1. This flag FU is set to 1, when shift operation is not completed yet, although shift up operator command was started, and when that is not right, it is

set to 0. If it is not [ shift up / be / it ] under operation, this flag FU will be 0 and will progress to Step F51. At this step F51, Flag FD judges in 1. This flag FD is set to 1, when shift operation is not completed yet, although down-shift operator command was started, and when that is not right, it is set to 0. If it is not [ down-shift / be / it ] under operation, this flag FD will be 0 and will progress to Step F52.

[0120] At this step F52, Flag FB judges in 1. This flag FB is set to 1, when shift operation is not completed yet, although the shift operator command to the optimal gear ratio was started, and when that is not right, it is set to 0. If it is not [ shift / be / it ] under operation, this flag FB will be 0 and will carry out a return. Here, if a driver operates change lever 4A into the position of UP or DOWN, when it will fulfill shift conditions, a shift up or a down shift is performed.

[0121] For example, if change lever 4A is changed from S position to UP position at the time of a run, from Step F6, it will progress to Step F10 through Steps F7 and F9, and it will be judged whether Flag FN is 1. This flag FN is set to 1 when change lever 4A is N position in front of S position, and when that is not right (i.e., when change lever 4A is operated by the position of UP or DOWN in front of S position), it is set to 0. And when Flag FN is 0, it performs at a time one step of a shift up or the usual shift operation which carries out a down shift, and when Flag FN is 1, shift operation directly shifted to the optimal gear ratio for a run state is performed.

[0122] That is, since a change gear is usually shifted, operating change lever 4A into the position to UP or DOWN, before S position, change lever 4A is at the position to UP or DOWN, and there is nothing into N position. Then, Flag FN is set to 0 at this time. When Flag FN is 0, it progresses to Step F78 and it is judged whether the optimal shift switch 26 is ON, and if the optimal shift switch 26 is not ON, it will progress to Step F11, and it is judged whether the above-mentioned flag FU is 1. Moreover, if the optimal shift switch 26 is ON, it will progress to Step F23.

[0123] At Step F11, since change lever 4A is changed, shift operator command is not performed yet in the first control cycle and Flag FU is not 1, it progresses to Step F12 and it is judged whether the present gear ratios SNR are 7 \*\* (7th). If the present gear ratios SNR are 7 \*\* (7th), since a shift up cannot be carried out any more any longer, it progresses to Step F8, and sounds and warns of the alarm buzzer 14. Naturally, gear change instructions are not performed.

[0124] If the present gear ratios SNR are not 7 \*\* (7th), it will progress to Step F13 and will be set as the gear ratio SNC which sets gear ratio SNR+1 on one step as a shift target rather than the present gear ratio SNR. Furthermore, it progresses to Step F14 and the shift instructions to the target gear ratio SNC are performed. That is, the command signal corresponding to either of electro-magnetic valve MVA-MVF is outputted. And Flag FU is set as 1 at Step F15, Flag FD is set as 0 at Step F16, and Flag FB is set as 0 at Step F17. And still, although it judges whether the present gear ratio SNR turned into the target gear ratio SNC at Step F18, since the present gear ratio SNR is not the target gear ratio SNC, a return is carried out at the time of a shift instruction start.

[0125] And if UP position is held, the step of Steps F1, F2, F3, F4, F5, F6, F7, F9, F10, F11, F12, F13, F14, F15, F16, F17, and F18 will be repeated, and shift instructions will be continued. If a shift up is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F19 and the reaction force of change lever 4A will be removed from Step F18. That is, output a control signal from the semi automatic T/M control unit 11, change electromagnetic 3 way bulb 36A into a discharge state, the reaction force grant mechanism 27 is made to cancel, and the reaction force of change lever 4A is extracted.

[0126] And Flag FH is set to 0 at Step F20, Flag FU is set to 0 at Step F21, and the return of the flag FN is further carried out and carried out to 0 at Step F22. On the other hand, if operation to S position from N position is performed before being operated by this UP position, Flag FN will be set to 1, it will progress to Step F23 from Step F10 through Steps F1, F2, F3, F4, F5, F6, F7, and F9, and it will be judged whether the above-mentioned flag FB is 1. Moreover, if the optimal shift switch 26 is ON, it will progress to Step F23 from Step F78, and it will be judged whether the above-mentioned flag FB is 1.

[0127] If shift operator command is not performed, it progresses to Step F24 and the optimal gear ratio SNB for the present run state is calculated from vehicle speed information etc. The best gear ratio SNmax in the area within an engine speed necessary in the time of a shift up to

this optimal gear ratio SNB (in this example, they are 2300 or less rpm at 600 or more rpm) It is set up. That is, the gear ratio SNmax best in the range of 600 or more rpm of minimum rotational frequencies of the area within an engine speed It is set up.

[0128] And at continuing Step F25, the optimal gear ratio SNB is set as the target gear ratio SNC. Furthermore, the shift instructions to the target gear ratio SNC are performed at Step F26. That is, the command signal corresponding to either of electro-magnetic valve MVA-MVF is outputted. And Flag FB is set as 1 at Step F27, Flag FU is set as 0 at Step F28, and Flag FD is set as 0 at Step F29. And still, although it judges whether the present gear ratio SNR turned into the target gear ratio SNC at Step F30, since the present gear ratio SNR is not the target gear ratio SNC, a return is carried out at the time of a shift instruction start.

[0129] And if UP position is held, the step of Steps F1, F2, F3, F4, F5, F6, F7, F9, F10, F23, F24, F25, F26, F27, F28, F29; and F30 will be repeated, and shift instructions will be continued. If a shift is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F31 and the reaction force of change lever 4A will be removed from Step F30 like the above-mentioned. That is, output a control signal from the semi automatic T/M control unit 11, change electromagnetic 3 way bulb 36A into a discharge state, the reaction force grant mechanism 27 is made to cancel, and the reaction force of change lever 4A is extracted.

[0130] And Flag FH is set to 0 at Step F32, Flag FB is set to 0 at Step F33, and the return of the flag FN is further carried out and carried out to 0 at Step F34. Moreover, if change lever 4A is changed from S position to a DOWN position at the time of a run, from Step F6, it will progress to Step F36 through Steps F7, F9, and F35, and it will be judged whether Flag FN is 1.

[0131] Usually, since Flag FN is 0, it progresses to Step F79, it is judged whether the optimal shift switch 26 is ON, if the optimal shift switch 26 is not ON, it will progress to Step F37, and if the optimal shift switch 26 is ON, it will progress to Step F23. If it progresses to Step F37, it will be judged whether the above-mentioned flag FD is 1.

[0132] Since change lever 4A is changed, shift operator command is not performed yet in the first control cycle and Flag FD is not 1, it progresses to Step F38 and it is judged whether the present gear ratio SNR is the 1st speed (1st). If the present gear ratio SNR is the 1st speed (1st), since a down shift cannot be carried out any more any longer, it progresses to Step F8, and sounds and warns of the alarm buzzer 14. Naturally, gear change instructions are not performed.

[0133] If the present gear ratio SNR is not the 1st speed (1st), it will progress to Step F39 and gear ratio SNR-1 under one step will be set as the target gear ratio SNC rather than the present gear ratio SNR. And it judges whether at continuing Step F40, even if it carries out a down shift to the target gear ratio SNC, an engine overruns. This judgment can be performed by calculating the engine speed after a down shift from the present vehicle speed and the target gear ratio SNC, and comparing this with overrun threshold value.

[0134] If it is overrunning by this judgment, it will progress to Step F8, will sound and warn of the alarm buzzer 14, and gear change instructions will not be performed. If it is not overrunning, it will progress to Step F41 and down-shift instructions will be performed. That is, the command signal corresponding to either of electro-magnetic valve MVA-MVF is outputted. Furthermore, Flag FD is set as 1 at Step F42, Flag FU is set as 0 at Step F43, and Flag FB is set as 0 at Step F44. And still, although it judges whether the present gear ratio SNR turned into the target gear ratio SNC at Step F45, since the present gear ratio SNR is not the target gear ratio SNC, a return is carried out at the time of a shift instruction start.

[0135] And if a DOWN position is held, the step of Steps F1, F2, F3, F4, F5, F6, F7, F9, F35, F36, F37, F38, F39, F40, F41, F42, F43, F44, and F45 will be repeated, and shift instructions will be continued. If a down shift is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F46 and the reaction force of change lever 4A will be removed from Step F45. That is, output a control signal from the semi automatic T/M control unit 11, change electromagnetic 3 way bulb 36A into a discharge state, the reaction force grant mechanism 27 is made to cancel, and the reaction force of change lever 4A is extracted.

[0136] And Flag FH is set to 0 at Step F47, Flag FD is set to 0 at Step F48, and the return of the flag FN is further carried out and carried out to 0 at Step F49. On the other hand, if



operation to S position from N position is performed before being operated by this DOWN position, Flag FN will be set to 1 and it will progress to Step F23 from Step F36 through Steps F1, F2, F3, F4, F5, F6, F7, F9, and F35. Moreover, if the optimal shift switch 26 is ON, it will progress to Step F23 from Step F78. And the same step as the time of the operation to the above-mentioned UP position is performed.

[0137] That is, if it is judged whether the above-mentioned flag FB is 1 and shift operator command is not performed at Step F23, it progresses to Step F24 and the optimal gear ratio SNB for the present run state is calculated from vehicle speed information etc. The lowest gear ratio SNmin in the area within an engine speed necessary in the time of a shift up to this optimal gear ratio SNB (in this example, they are 2300 or less rpm at 600 or more rpm) It is set up. That is, the gear ratio SNmin lowest in the range of 2300 or less rpm of minimum rotational frequencies of the area within an engine speed It is set up.

[0138] And the optimal gear ratio SNB is set as the target gear ratio SNC at continuing Step F25. Furthermore, the shift instructions to the target gear ratio SNC are performed at Step F26. That is, the command signal corresponding to either of electro-magnetic valve MVA-MVF is outputted. And Flag FB is set as 1 at Step F27, Flag FU is set as 0 at Step F28, and Flag FD is set as 0 at Step F29. And a return is carried out, if it judges whether the present gear ratio SNR turned into the target gear ratio SNC and the present gear ratio SNR is not the target gear ratio SNC at Step F30.

[0139] And if a DOWN position is held, the step of Steps F1, F2, F3, F4, F5, F6, F7, F9, F35, F36, F23, F24, F25, F26, F27, F28, F29, and F30 will be repeated, and shift instructions will be continued. If a shift is completed and the real gear ratio SNR becomes equal to the target gear ratio SNC, it will progress to Step F31 and the reaction force of change lever 4A will be removed from Step F30 like the above-mentioned. That is, output a control signal from the semi automatic T/M control unit 11, change electromagnetic 3 way bulb 36A into a discharge state, the reaction force grant mechanism 27 is made to cancel, and the reaction force of change lever 4A is extracted.

[0140] And Flag FH is set to 0 at Step F32, Flag FB is set to 0 at Step F33, and the return of the flag FN is further carried out and carried out to 0 at Step F34. In addition, also at the time of this shift up, a down shift, and the optimal shift, the target gear ratio SNC outputs a command signal which will be in a free passage state to electromagnetic 3 way bulb 36C so that the shift force may become large at the time of 2nd speed instructions.

[0141] However, although change lever 4A was changed to UP position or the DOWN position When change lever 4A has been returned to S position before completion of shift operation Since Flag FU is set to 1 at Step F15, or Flag FB is set to 1 at Step F27, or Flag FD is set to 1 and it grazes at Step F42 By judgment of Step F50, Step F51, or Step F52, it progresses to Step F53, the neutral value N is set up as a target gear ratio SNC, and the signal which corresponds at Step F54 is outputted to either of electro-magnetic valve MVA-MVF.

[0142] Furthermore, it progresses to Step F55 and it is judged whether the real gear ratio SNR is equal to the target gear ratio SNC (here the neutral value N), and a return is carried out if the real gear ratio SNR is not equal to the target gear ratio SNC. And from Steps F1, F2, F3, F4, F5, and F6, through F50, F50 and F51, or F50, F51 and F52, the step of F53, F54, and F55 is repeated, and a shift in a neutral is completed. When the real gear ratio SNR becomes equal to the target gear ratio SNC, from Step F55 It progresses to Step F56, Flag FU is set as 0, Flag FD is set as 0 at Step F57, Flag FB is set as 0 at Step F58, and the return of the flag FD is set up and carried out to 0 at Step F59.

[0143] Moreover, if it changes from N position to R position at the time of a run, it will progress to Step F8 from Steps F1, F2, F3, F4, F5, F6, and F7, and will sound and warn of the alarm buzzer 14. Though natural, gear change instructions are not performed. Thus, it can run, choosing a suitable gear ratio changing change lever 4A to UP position or a DOWN position. Moreover, at the time of a down shift, since it is confirmed whether an engine overruns for the selected gear ratio, protection of an engine can also be aimed at.

[0144] Moreover, it will be shifted to the optimal gear ratio SNB, if it notices that change lever 4A misoperated after the start of change operation when it was going to perform change



operation to UP position or a DOWN position, and change lever 4A is returned before the completion of a shift and change lever 4A will be operated to UP position or a DOWN position by next, since it is returned to a neutral.

[0145] In this case, if change lever 4A is operated from a neutral state to UP position or a DOWN position also to except, since it will be shifted to the optimal gear ratio SNB, the selection mistake of a gear ratio is avoidable. Next, an example of control in auto-shift mode is concretely explained with reference to the flow chart of drawing 8.

[0146] As shown in drawing 8, the signal from each sensor or switches is first inputted into the semi automatic T/M control unit 11 and the electronic centrifugal-spark-advancer control unit 12 at Step A1. At the following steps A2-A6, although the time of treading in to a brake pedal and the brake pedal have not broken in, they set up the gear change shift map MAP according to three sorts of run states with the time of there being also no exhaust brake in an operating state, respectively, without getting also into the time of an exhaust brake being in an operating state, and a brake pedal.

[0147] That is, if it is judged whether it gets into the brake pedal and it gets into the brake pedal at Step A2, it will progress to Step A3 and a map map3 will be set as the gear change shift map MAP. If it does not get into the brake pedal, it progresses to Step A4 from Step A2, and it is judged for an exhaust brake whether it is an ON state, if an exhaust brake is an ON state, it will progress to step A5 and a map map2 will be set as the gear change shift map MAP.

[0148] If an exhaust brake is not an ON state, although a map map1 will usually be set as the gear change shift map MAP at the time of gear change, if change lever 4A is operated in the case of this automatic gear change mode, the gear change shift map MAP will be changed here. That is, map map1N, map1P, and map1E are usually prepared as a shift map map1 at the time of gear change, and although map map1N is a standard shift map (normal shift map), it receives. Map map1P are the power shift map which enabled it to obtain a big engine output rather than this normal shift map map1N using the high rotation region of an engine. Map map1E is the economy shift map which enabled it to operate an engine economically rather than normal shift map map1N using the low rotation region of an engine.

[0149] And if the gear change map map1 will usually be changed to an economy side rather than this if operation of a shift up is performed, although normal shift map map1N is usually first used as the gear change map map1 when it switches to automatic gear change mode, and operation of a down shift is performed, the gear change map map1 will usually be changed to a power side rather than this.

[0150] That is, first, when it switches to automatic gear change mode, although normal shift map map1N is usually used as the shift map map1 at the time of gear change, if it is that operation of a shift up is performed, it will progress to Step A6 and the shift map by the side of an economy will be set as the gear change shift map MAP rather than normal shift map map1N by judgment of Step A33, after this. Moreover, in the state of normal shift map map1N, it progresses to Step A34 from Step A33, and if it is that operation of a down shift is performed by judgment of this step A34, it will progress to Step A35 and the shift map by the side of power will be set as the gear change shift map MAP.

[0151] In addition, although it is indicated as map1 (E) and map1 (P) in Step A6 and A35 map1 (P) means the shift map by the side of one-step power rather than what is usually actually set up as a shift map map1 at the time of gear change. map1 (E) Usually, the shift map by the side of an one-step economy is meant rather than what is actually set up as a shift map map1 at the time of gear change.

[0152] For example, if the shift map map1 is usually normal shift map map1N at the time of gear change, map1 (P) shows power shift map map1P by the side of one-step power rather than this, and map1 (E) shows power shift map map1E by the side of an one-step economy rather than this now. Moreover, if the shift map map1 is power shift map map1P at the time of the usual gear change which is set up now and which map1 (P) shows normal shift map map1N by the side of one-step power rather than this if the shift map map1 is usually economy shift map map1E at the time of gear change, and is set up now, map1 (E) will show normal shift map map1N by the side of an one-step economy rather than this.

[0153] If the gear change shift map MAP is changed to the shift map by the side of power, although it will be based also on the vehicle speed and an engine load (accelerator control input), a down shift will be carried out and an engine comes to have the large high rotation region of an output used. Moreover, if the gear change shift map MAP is changed to the shift map by the side of an economy, although it will be based also on the vehicle speed and an engine load (accelerator control input), a shift up will be carried out and an engine comes to have a low rotation region with little fuel consumption used.

[0154] And if change lever 4A is not operated after this, the set-up shift map MAP is continued as it is. Thus, if set as the gear change shift map MAP, it will progress to Step A7 and the target gear ratio SNC will be set up from the amount of accelerator pedal treading in, and the vehicle speed based on this gear change shift map MAP.

[0155] It is judged at the following step A8 whether a shift is required. For example, the present gear ratio SNR is compared with the target gear ratio SNC, and if these differ, it can be judged that a shift is required. Although a return will be carried out since the present gear ratio SNR is in the optimal state if a shift is unnecessary, if a shift is required, it will progress to step A9 and shift control will be started.

[0156] First, it controls by step A9-A12 to return an accelerator regardless of the operation state of an accelerator pedal. That is, it judges whether a flag FAC1 is 0 by step A9. Although this flag FAC1 will be set to 1 if accelerator return control is completed, it is set to 0 at the time of a shift control start, and progresses to Step A10. From the electronic centrifugal-spark-advancer control unit 12, an accelerator return signal is outputted and electronic centrifugal-spark-advancer 1A is controlled by this step A10. This is Step A11, and it is performed until it judges that accelerator return was completed.

[0157] If accelerator return is completed, a flag FAC1 will be set to 1 at Step A12, and a clutch will be intercepted at Steps A13-A16. That is, it judges whether a flag FCR1 is 0 at Step A13. Completion of interception of a clutch sets this flag FCR1 to 1. At continuing Step A14, an operation command signal is outputted to electromagnetic bulb 36E from the semi automatic T/M control unit 11. By this, electromagnetic bulb 36E operates, air \*\* is supplied to clutch booster 2A, and a clutch 2 is changed into an isolation state.

[0158] And if a clutch is judged that interception (OFF) was completed at Step A15, Flag FCR will be set to 1 at Step A16, and a gear will be returned to a neutral at Steps A17-A20. That is, it judges whether a flag FGN1 is 0 at Step A17. Completion of return in the neutral of a gear sets this flag FGN1 to 1. At continuing Step A18, an active signal is outputted to the necessary electro-magnetic valve of electro-magnetic valve MVA-MVF of gearshift unit 3A from the semi automatic T/M control unit 11. Thereby, the engagement state of the gear mechanism of the main part 3 of a change gear is returned to a neutral position.

[0159] If it judges that return in the neutral of a gear was completed at Step A19, at Step A20, Flag FGN will be set to 1, and a control signal will be outputted by Step A21 so that it may be set to electronic centrifugal-spark-advancer 1A from the electronic centrifugal-spark-advancer control unit 12 to a necessary engine speed. That is, the target rotational frequency of an engine is set up from a target gear ratio and the real vehicle speed, and electronic centrifugal-spark-advancer 1A is controlled so that the rotational frequency of the actual engine obtained from an engine speed sensor 22 approaches a target rotational frequency.

[0160] And a gear is returned to a neutral at Steps A22-A25. That is, it judges whether Flag FSNC is 0 at Step A22. Completion of a shift for the target gear ratio of a gear sets this flag FSNC to 1. At continuing Step A23, an active signal is outputted to the necessary electro-magnetic valve of electro-magnetic valve MVA-MVF of gearshift unit 3A from the semi automatic T/M control unit 11. Thereby, the engagement state of the gear mechanism of the main part 3 of a change gear is changed to a target gear ratio SNC position.

[0161] If it judges that the change for the target gear ratio SNC of a gear was completed at Step A24, Flag FSNC will be set to 1 at Step A25. Furthermore, if the rotational frequency of an engine is judged to have been controlled by the necessary state at Step A26, a clutch will be joined at Steps A27-A30. That is, it judges whether a flag FCR2 is 0 at Step A27. Completion of junction of a clutch sets this flag FCR2 to 1. At continuing Step A28, an operation command

signal is outputted to electromagnetic bulb 36F from the semi automatic T/M control unit 11. By this, electromagnetic bulb 36F operate, air \*\* of clutch booster 2A is removed, and a clutch 2 is changed into a junction state.

[0162] If it judges that junction of a clutch was completed at Step A29, at Step A30, a flag FCR2 will be set to 1 and accelerator adjustment will return to the usual state corresponding to the operation state of an accelerator pedal by Step A31. That is, if the signal corresponding to the clutch having joined is outputted from a clutch switch, while the output of the imagination amount signal of treading in from the semi automatic T/M control unit 11 will be finished, in the electronic centrifugal-spark-advancer control unit 12, it returns to the usual control state which controls electronic centrifugal-spark-advancer 1A corresponding to the amount signal of treading in of an accelerator pedal, and adjusts the output state of an engine.

[0163] Furthermore, at Step A31, each returns a flag FAC1, a flag FCR1, Flag FGN, Flag FSNC, and a flag FCR2 to 0, and shift operation by a series of automatic gear changes is completed. Thus, if auto-shift mode and manual shift mode can be chosen and it is made auto-shift mode according to liking of a driver, a driver becomes unnecessary to carry out shift operation in a high speed gear region with this semi automatic formula change gear equipment specially. For this reason, for example on a highway, the burden of the driver about shift operation is sharply mitigated by setting it as this auto-shift mode, and defatigation of the driver produced in connection with operation is also suppressed greatly.

[0164] Moreover, by the small force of only operating a change lever, when it is set as manual shift mode, since it can shift by finger touch, the burden of the driver about shift operation is mitigated and defatigation of the driver produced in connection with operation is also suppressed. And since [ the conditions which perform auto-shift mode ] a gear ratio restricts to a high speed gear region, \*\*\*\* operation of a clutch can be performed only by simple on-off operation. Then, complication of the structure of clutch booster 2A and complication of the control can be avoided now, and there is an advantage which can contribute to the cost reduction of equipment and improvement in reliability here.

[0165] Moreover, since this change lever 4A is set as the above I type shift patterns, there are the following advantages compared with the thing of the conventional H type shift pattern. That is, in the change lever of H type shift pattern adopted as the common manual change lever, the position according to each gear ratio is set up. With this equipment, since there are seven steps of advance and one step of go-astern, if the thing of H type shift pattern is used, eight positions are needed. Therefore, it complicates and is easy to enlarge structure of the portion of a manual change lever, and is hard to operate it at the time of a shift.

[0166] Moreover, considering changing manual shift mode and auto-shift mode, by the thing of H type shift pattern, if a change lever is not shifted with the shift of a gear ratio at the time of auto-shift mode, either, a change lever and a gear ratio stop having consistency, and fault is caused. That is, if a change lever and a gear ratio do not have consistency when it changes from auto-shift mode to manual shift mode, a driver will become easy to recognize the present gear ratio incorrect, and will cause the fault on shift operation also at this point. Then, although it will be necessary to have the mechanism which shifts a change lever with the shift in auto-shift mode, such a mechanism complicates the structure of the portion of a manual change lever further, and tends to cause the increase of large cost.

[0167] On the other hand, in change lever 4A of I type shift pattern of this equipment, a substantial shift position is three, R (reverse), UP (shift up), and DOWN (down shift), and the structure of the portion of a manual change lever becomes simple, and tends to miniaturize it. For this reason, shift operation is easy. Moreover, in addition to the time of shift operation, change lever 4A is in the position of N (neutral) or S (run), and the gear ratio position chosen can be recognized from the display unit 13. At the time of auto-shift mode, the display of the display unit 13 is changed with the shift of a gear ratio.

[0168] Therefore, when it changes from auto-shift mode to manual shift mode, it is not necessary to move the change lever itself, and the fault that a change lever and a gear ratio do not have consistency is canceled, and it can move from the driver to the manual shift, recognizing the present gear ratio appropriately. Moreover, fault which as actual shift [ as the

state of hand control and the automatic circuit changing switch 5 ] mode does not adjust, without driving specially hand control and the automatic circuit changing switch 5 when it changes to the manual shift mode from auto-shift mode with other meanses without operating hand control and the automatic circuit changing switch 5, for example, since hand control and the automatic circuit changing switch 5 were held at the state where it is always fixed at least in addition to the time of operation is avoidable. And a driver can be operated, recognizing the present shift mode easily, looking at the display of the display unit 13.

[0169] Furthermore, where the optimal shift switch 26 is put into ON at the time of manual shift mode If change lever 4A is put into UP position, in the range from which the rotation by which the necessary engine of the area within an engine speed (getting it blocked 600 or more rpm) was stabilized is secured Highest gear ratio SNmax A jump shift is also attained, and conversely, where the optimal shift switch 26 is put into ON It is the low gear ratio SNmax most at the range from which the rotation by which the necessary engine of the area within an engine speed (getting it blocked 2300 or less rpm) was stabilized will be secured if change lever 4A is put into a DOWN position. A jump shift is also attained. Thus, though it is I type shift pattern, since a jump shift can be performed, the range of selection of shift operation of a driver spreads, and there is an advantage to which a driver can carry out a favorite shift change.

[0170] Moreover, if change lever 4A is put into UP position at the time of auto-shift mode, although the gear change shift map MAP will be changed to the shift map by the side of an economy and will be based also on the vehicle speed and an engine load (accelerator control input), the few run pattern of fuel consumption can be chosen, a shift up being carried out and maintaining an engine at a low rotation region.

[0171] On the contrary, if change lever 4A is put into a DOWN position at the time of auto-shift mode, although the gear change shift map MAP will be changed to the shift map by the side of power and will be based also on the vehicle speed and an engine load (accelerator control input), a run pattern while using a big engine output can be chosen, a down shift being carried out and maintaining an engine at a high rotation region.

[0172] Thus, during the run, according to rolling-stock-run environment etc., only a certain period can choose a sport run, an economy run can be chosen, or carrying out can carry out now easily promptly, and the driver can perform more comfortably the drive at the time of an automatic gear change run with this semi-automatic formula change gear equipment. Moreover, unless the signal of shift control is outputted on condition that it will get into clutch pedal 6, if change lever 4A is operated, reaction force is given to change lever 4A and it gets into clutch pedal 6 at the time of manual shift mode, the signal of shift control is not outputted and reaction force is not given to change lever 4A. For this reason, while being able to aim at protection of a clutch 2, it can recognize that shift operation does not accept by reaction force not being given to change lever 4A for a driver.

[0173] Moreover, since reaction force will be given to change lever 4A from the predetermined position near UP, DOWN, or R if change lever 4A is shifted to UP, DOWN, or R when getting into clutch pedal 6, a driver can recognize that shift operation has accepted. Furthermore, if a shift for the gear ratio which carried out shift instructions by this change lever 4A is completed, since reaction force will be removed by change lever 4A, a driver can recognize that shift operation was completed.

[0174] Moreover, before a shift for the gear ratio which carried out shift instructions is completed in the middle of this shift operation during a run, if change lever 4A is returned at S from UP or DOWN, or N (namely, before the reaction force of change lever 4A is removed), a gear ratio will return at N (neutral), and it will be shifted to the optimal gear ratio if change lever 4A is again shifted to UP or DOWN after this. For this reason, the instructions which the gear change shift mistook are appropriately [ promptly and ] avoidable.

[0175] Furthermore, since it is outputted with an electrical signal, such instructions of change lever 4A are setting situations attached to change lever 4A, such as a contact for generating a signal, and having shifted change lever 4A slightly can also output desired instructions now, and they can raise control responsibility. The shift force is enlarged only when requiring the big shift force at the time of a shift for a target gear ratio. the big shift force \*\*\*\* in addition, when there

is nothing Since the shift force is set as an ordinary size, a synchro ring, wear of a chamfer, etc. are suppressed in the shift force at the time of a shift in the high-speed stage which does not not much have \*\*\*\*, especially with this equipment Even if it sets up so that the shift force may be changed after receiving the signal with which change lever 4A was operated by the gear ratio which requires the shift force big, for example, since the responsibility to operation of change lever 4A is raised It can be made of use for shift operation, and an above-mentioned effect can be acquired certainly.

[0176] Moreover, when a control system should fail, only by setting a circuit changing switch 5 as manual shift mode also in emergency which electromagnetic bulb 36E operated, and air \*\* was supplied to clutch booster 2A, and became with the isolation state of a clutch 2, easily, air \*\* of clutch booster 2A is removed through electromagnetic bulb 36D, and a clutch 2 will be in an isolation state (OFF). For this reason, shift operation can also be carried out by manual shift next.

[0177] Moreover, since the command signal from change lever 4A can be changed to the direct-control mode sent to direct gearshift unit 3A through the emergency switch 23, without making the semi automatic T/M control unit 11 intervene when semi automatic T/M control unit 11 grade should fail, also in such a case, the way of shift operation is secured.

[0178] And a driver is in a panic state, at the time of urgent brake (panic brake) operation which does not step on clutch pedal 6 even if vehicles slow down, the clutch mechanism 2 has junction canceled automatically, and an engine shutdown is avoided by urgent brake tense section 11E. For this reason, prompt vehicles can be controlled also in emergency. An engine shutdown is avoidable, separation of a clutch mechanism being performed and obtaining the slowdown of \*\* and others or a \*\*\*\* request for engine brake effectively, after sudden braking is performed certainly, since the start of control is especially judged based on the deceleration of vehicles at the time of an urgent brake.

[0179] Moreover, if continuation of urgent clutch control becomes unnecessary, since this control will be finished promptly and it will return to the usual clutch control, engine shutdown evasion at the time of a panic brake can be realized, without spoiling the usual clutch operation nature. In addition, in this example, although the gear ratio is set as seven steps of advance, of course, the gear ratio of this change gear equipment is not limited to this. Moreover, although the 4th more than \*\* is set as the high-speed stage (getting it blocked possible field in auto-shift mode) of a gear ratio in this example, it cannot be overemphasized that this can also set up various high-speed stages (possible field in auto-shift mode) of a gear ratio according to the number of stages, the engine property, and the vehicles property that a change gear can change gears.

[0180] And although it is made for the shift force to become large by high-pressure air in this example only at the time of 2nd speed instructions as it will be in a free passage state about electromagnetic 3 way bulb 36C, it is made not to perform control which enlarges this shift force in the case of large gear change instructions of a shift drive load, and is not limited at the time of 2nd speed instructions. Moreover, you may make it the shift force become large by high-pressure air etc. also in the time of 2nd speed instructions only, for example at the time of the 2nd speed instructions by the down shift with a more large shift drive load.

[0181] Moreover, it may replace with air \*\* (pneumatic pressure) of this example, and other hydrostatic pressures, such as oil pressure, may be used.

[0182]

[Effect of the Invention] As explained in full detail above, while carrying out the \*\*\*\* drive of this clutch mechanism according to the clutch mechanism prepared in the output section of the engine for vehicles, and the operation of clutch pedal according to the semi automatic formula change gear equipment of this invention according to claim 1 The actuator for clutches which operates according to an electrical signal and carries out the \*\*\*\* drive of this clutch mechanism, The change gear which offered the gear mechanism which can change gears the rotational speed by the driving torque inputted from this engine through this clutch mechanism for two or more gear ratios, The actuator for gearshifts which shifts this gear ratio to a necessary state while operating according to an electrical signal and changing the engagement

state of the gear mechanism of this change gear, The hand control and the automatic selection operation means for changing alternatively the manual shift mode which shifts this gear ratio manually, and the auto-shift mode which shifts this gear ratio automatically, A shift operation means to be an operation means to perform operation for carrying out the manual shift of this gear ratio, and to output the signal according to this operation, An engine load detection means to detect the loaded condition of this engine, and a run state detection means to detect this rolling-stock-run state, It is based on a signal from this hand control and automatic selection operation means, this shift operation means, and this run state detection means. If this manual shift mode is chosen for these control means by offering the control means which output a command signal to this actuator for clutches, and this actuator for gearshifts, and control the operation According to the signal from this accelerator instruction means and this shift operation means, a command signal is outputted to this actuator for gearshifts. The remote-operation control section for manual gear change which performs manual gear change control by remote operation, If this auto-shift mode is chosen, it will respond to a detecting signal from this engine load detection means and this run state detection means. Choose a gear ratio, referring to a gear ratio selection map, and the command signal which corresponds to this actuator for clutches and this actuator for gearshifts is outputted. An urgent brake judgment means to offer the remote-operation control section for automatic gear change which performs automatic gear change control, to consist of controlling clutch interception operation, gearshift operation, and clutch junction operation, and to judge the existence of urgent brakes operation, By composition that the urgent brake tense section which outputs a emergency control signal to this actuator for clutches so that junction of this clutch mechanism may be automatically canceled based on the information from this urgent brake judgment means at the time of urgent brakes operation is prepared Without causing the steep increase in a manufacturing cost, and enlargement of equipment, shift operation can be carried out easily and the burden of the driver about shift operation can be mitigated greatly.

[0183] And when not performing clutch OFF operation at the time of the so-called urgent brake of a panic state (at the time of a panic brake), combination of a clutch is canceled automatically and can avoid an engine shutdown. Therefore, vehicles can be appropriately controlled also in emergency. Moreover, according to the semi automatic formula change gear equipment of this invention according to claim 2 In composition according to claim 1, by in addition, composition that the degree of \*\* of this urgent brake judgment means is carried out so that it may judge that urgent brakes operation is performed as the deceleration of the vehicles at the time of brakes operation is beyond a predetermined value An engine shutdown is avoidable, separation of a clutch mechanism being performed and obtaining the slowdown of \*\* and others or a \*\*\*\* request for engine brake effectively, after sudden braking is performed certainly.

[0184] Moreover, according to the semi automatic formula change gear equipment of this invention according to claim 3 In composition according to claim 1 or 2, in addition, a wheel lock detection means to detect the lock state of the wheel of these vehicles, A clutch \*\*\*\* detection means to detect interception operation of this clutch mechanism by this clutch pedal is offered. This urgent brake tense section during the control signal output of junction release of this clutch mechanism It is based on information from this wheel lock detection means and this clutch \*\*\*\* detection means. By composition of being set up so that it may suspend the output of this emergency control signal and may return to the manual clutch control according to operation of this clutch pedal, on condition that interception operation of this wheel not being in a lock state or this clutch mechanism is carried out Since a clutch mechanism returns to the manual clutch control according to operation of clutch pedal promptly when the clutch OFF control which avoids an engine shutdown is unnecessary, engine shutdown evasion at the time of a panic brake can be realized without spoiling the usual clutch operation nature.